Interim Report of the Committee on Specifications and Tolerances

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Reference
Key Number

300 Introduction

The Specifications and Tolerances (S&T) Committee submits its Interim Report for consideration by the National Conference on Weights and Measures (NCWM). This report contains the items discussed and actions proposed by the Committee during its Interim Meeting at the Omni Jacksonville Hotel, Jacksonville, Florida on January 12-15, 2003.

Table A identifies the agenda items in the Report by Reference Key Number, Item Title, and Page Number. The item numbers are those assigned in the Interim Meeting Agenda. Voting items are indicated with a **"V"** after the item number. Items marked with an **"I"** after the reference key number are information items. Items marked with a **"D"** after the key number are developing issues. The developing designation indicates an item has merit; however, the item is returned to the submitter for further development before any action at the national level. The items marked with a **"W"** were withdrawn by the Committee. Items marked with a **"W"** generally will be referred to the regional weights and measures associations because they either need additional development, analysis, and input, or do not have sufficient Committee support to bring them before the NCWM.

The attached Report contains many recommendations to revise or amend National Institute of Standards and Technology (NIST) Handbook 44, 2003 Edition, "Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices." Proposed revisions to the handbook are shown in **bold face print** by ~~crossing out~~ information to be deleted, and underlining information to be added. Requirements that are proposed to be nonretroactive are printed in *italics*. Entirely new paragraphs or sections proposed for adding to the handbook are designated and shown in **bold face print**.

Note: The policy of the National Institute of Standards and Technology is to use metric units of measurement in all of its publications; however, recommendations received by the NCWM technical committees have been printed in this publication as they were submitted and may, therefore, contain references to inch-pound units.

Table A
Index to Reference Key Items

Table B
Appendices

Details of all Items
(In order by Reference Key Number)

310 General Code

310-1 V G-S.1. Identification; Software Based Devices, and Appendix D; Definition of Built-for-Purpose Device

Source: Carryover Item 310-1. (This item was developed by the National Type Evaluation Technical Committee (NTETC) Measuring Sector and first appeared on the Committee's 2002 agenda.)

Recommendation: Amend NIST Handbook 44, General Code G-S.1. Identification (d) as follows:

G-S.1. Identification. - All equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect, shall be clearly and permanently marked for the purposes of identification with the following information:

(a) the name, initials, or trademark of the manufacturer or distributor;

(b) a model designation that positively identifies the pattern or design of the device;

(c) ***the model designation shall be prefaced by the term "Model," "Type," or "Pattern." These terms may be followed by the term "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.). The abbreviation for the word "Model" shall be "Mod" or "Mod."***
[Nonretroactive as of January 1, 2003]
(Added 2000) (Amended 2001)

[Note: Prefix lettering may be initial capitals, all capitals or all lower case.]

(d) except for equipment with no moving or electronic component parts and software-based not built-for-purpose devices, a nonrepetitive serial number;
[Nonretroactive as of January 1, 1968]

(e) for software-based not built-for-purpose devices the current software version designation;

(f)~~(e)~~ the serial number shall be prefaced by words, an abbreviation, or a symbol that clearly identifies the number as the required serial number; and
[Nonretroactive as of January 1, 1986]

(g)~~(f)~~ the serial number shall be prefaced by the words "Serial Number" or an abbreviation of that term. Abbreviations for the word "Serial" shall, as a minimum, begin with the letter "S," and abbreviations for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., S/N, SN, Ser. No, and S No.).
[Nonretroactive as of January 1, 2001]

(h)~~(g)~~ For devices that have an NTEP Certificate of Conformance (CC) Number or a corresponding CC addendum number, the NTEP CC shall be prefaced by the terms "NTEP CC," "CC," or "Approval." These terms may be followed by the term "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.).
[Nonretroactive as of January 1, 2003]

The required information shall be so located that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device.
(Amended 1985, 1991, 1999 and 2000)

Add new paragraph G-S.1.1. and renumber existing paragraph G-S.1.1. as follows:

G-S.1.1. Software-Based, Not Built–For–Purpose Devices. - For software based, not built–for–purpose devices, the following shall apply:

(a) the manufacturer or distributor and the model designation be continuously displayed or marked on the device*, or

(b) the Certificate of Conformance (CC) Number be continuously displayed or marked on the device*, or

(c) all required information in G-S.1. Identification. (a), (b), (c), (e), and (h) be continuously displayed. Alternatively, a clearly identified System Identification, G-S.1. Identification, or Weights and Measures Identification shall be accessible through the "Help" menu. Required information includes that information necessary to identify that the software in the device is the same type that was evaluated.

****Clear instructions for accessing the remaining required information shall be listed on the CC. Required information includes that information necessary to identify that the software in the device is the same type that was evaluated.***
[Nonretroactive as of January 1, 200X]

G-S.1.~~1~~2. Remanufactured Devices and Remanufactured Main Elements. - All remanufactured devices and remanufactured main elements shall be clearly and permanently marked for the purpose of identification with the following information:

(a) the name, initials, or trademark of the last remanufacturer or distributor;

(b) the remanufacturer's or distributor's model designation if different than the original model designation.
[Nonretroactive as of January 1, 2002]

Add a new definition for "built-for-purpose" devices as follows:

built-for-purpose device. Any main device or element which was manufactured with the intent that it be used as, or part of, a weighing or measuring device or system.

Background/Discussion: At the 2002 NCWM Interim and Annual Meetings, the S&T Committee reviewed and received comments on two proposals to address marking requirements for software based not built-for-purpose devices. One proposal was developed and submitted by the NTETC Measuring Sector. The other proposal was developed and submitted by the NTETC Weighing Sector. The Committee asked that the NTETC Measuring and Weighing Sectors review both proposals and attempt to agree on a single proposal that is acceptable to all parties.

At its September 2002 Meeting, the NTETC Weighing Sector developed a new proposal based on both of the proposals submitted last year. That proposal was forwarded to the NTETC Measuring Sector for review and comment.

At its October 2002 Meeting, the NTETC Measuring Sector reviewed the proposal developed by the Weighing Sector and concurred with the intent of the proposal. The Measuring Sector recommended some changes to the proposal and agreed to forward it to the NCWM S&T Committee for consideration. The modified proposal was also sent to the Weighing Sector members along with a ballot requesting approval of the modifications. The result of the ballot was 9 affirmative votes, 1 negative vote, and 3 members abstained.

At its October 2002 Annual Meeting, the SWMA supported the direction of the NTETC Measuring Sector on this item and encourages a unified position of both the NTETC Measuring and Weighing Sectors.

At the 2003 NCWM Interim Meeting, the Committee heard support for the proposal developed by the Measuring Sector at its October 2002 Meeting as written. The Committee also heard that the proposal should include built-for-purpose devices. The Committee agreed that for software-based systems the software version number has greater value than a serial number. The committee also agreed that the word "may" should be removed from the proposed G-S.1.1. (a), (b), and (c.) The Committee agreed to continue limiting the proposal to not built-for-purpose devices at this time and to present the item for a vote at the 2003 NCWM Annual Meeting.

For more background information, refer to the 2002 S&T Final Report.

320 Scales

320-1 V S.1.12. Manual Gross Weight Entries and UR.3.9. Use of Manual Gross Weight Entries

Source: Carryover Item 320-4. (This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 2002 agenda.)

Recommendation: Modify paragraphs S.1.12. and UR.3.9. as follows:

> ***S.1.12. Manual ~~Gross~~ Weight Entries. – A device shall accept an entry of a manual ~~gross~~ weight value only when the scale is at gross load zero and the scale gross or net* weight indication is at zero ~~in the gross weights display mode~~. Recorded manual weight entries except those on labels generated for packages of standard weights, shall identify the weight value as a manual weight entry by one of the following terms: "Manual Weight," "Manual Wt," or "MAN W." The use of a symbol to identity multiple manual weight entries on a single document is permitted, provided that the symbol is defined on the same page on which the manual weight entries appear and the definition of the symbol is automatically printed by the recording element as part of the document.***
> ***[Nonretroactive as of January 1, 1993]***
> ***[*Nonretroactive as of January 1, 2004.]***
>
> **UR.3.9. Use of Manual ~~Gross~~ Weight Entries. – Manual ~~gross~~ weight entries are permitted for use in the following applications only: (1) on a point-of-sales system interfaced with scales when credit is given for a weighed item ~~on point-of-sale systems interfaced with scales~~, or when an item is pre-weighed and marked with the correct net weight; (2) when a device or system is generating labels for standard weight packages; (3) when postal scales or weight classifiers are generating manifests for packages to be picked up at a later time; and (4) on livestock scale and vehicle scale systems generate weight tickets to correct erroneous tickets.**

Discussion: The proposal was developed to address concerns about practices for using manual weight entries on point-of-sale (POS) systems. One national grocery company manually enters weights into its POS system when an item (e.g., watermelons, turkeys, roasts, etc.) exceeds the capacity of the POS scale system or when the scanner system cannot read the Universal Product Code (UPC) on a random weight package, but the weight and price per pound are legible. These applications are not specifically addressed in NIST Handbook 44 for use of manual weight entries.

Several restrictions are placed on the use of manual weight entries in Handbook 44 to deter fraudulent use of the feature and to ensure that entries are properly identified. Paragraph UR.3.9. permits use of manual weight entries in applications where a credit is given on a POS system, to generate labels for standard weight packages, for postal weight manifests when packages are picked up at a later time, or to correct erroneous tickets generated by livestock or vehicle scales. Paragraph S.1.12. permits manual weight entries only when the scale is at gross load zero and the scale indication is zero. Paragraph S.1.12. also specifies that manual weight entries must be identified with specific terminology on labels (except standard weight packages) or tickets. The Committee had concerns that adding more applications to the list of acceptable

weighing operations, where manual entries are permitted, might not adequately recognize all weighing installations where manual weight entries are appropriate.

At the July 2002 NCWM Annual Meeting, the Committee recommended a more complete assessment of the field use of manual weight entries since not all involve gross weights. The Committee reviewed several proposals to modify paragraph UR.3.9. to address specific manual weight entry applications encountered by each submitter. The Committee agreed that the use of manual weight entries occurs with both gross and net weight packages, therefore, the proposals to modify paragraph UR.3.9., as worded, did not address all instances where manual weight entries occur. The Committee also discussed a proposal, developed by the Committee at the 2002 NCWM Interim Meeting, to address the various manual weight entries that occur nationally in weighing operations. The proposal modified paragraph S.1.12. to recognize manual weight entries for both gross and net weight packages and to require the system to identify and print manual tare entries.

The Committee agreed that changes were also necessary to paragraph UR.3.9. to ensure that the requirement is consistent with the proposed modifications to paragraph S.1.12. The Committee agreed to consider recommendations to modify paragraph UR.3.9. because corresponding changes are needed for device operators that use manual weight entries.

In September 2002, the Committee heard support from the WWMA to modify paragraph UR.3.9. to recognize manual weight entries on POS systems for marking the correct weight on preweighed item. The WWMA indicated that it is acceptable to manually enter weight and price information and use the POS system as a calculator. The WWMA also removed all references to the term "gross" from paragraph UR.3.9. to correspond with the changes recommended for paragraph S.1.12.

During the 2003 NCWM Interim Meeting, scale manufacturers indicated it would be too costly to require devices to print manual tare values. Scale manufacturers supported an alternate proposal to modify paragraph S.1.12. to specify that only "direct sale" devices accept manual weight entries.

The Committee was not certain that the WWMA proposal as written in paragraph UR.3.9. clearly identified which applications are permitted to use manual weight entries. Additionally, the Committee was not certain that the proposal permits manual weight entries for random weight packages. The Committee agreed the proposed language in paragraph S.1.12. may be misleading as to whether or not the device must print the value for each keyboard-, stored-, push-button- or digitally entered tare. Consequently, the Committee deleted any requirement to identify and print manual tare values on labels or recorded representation from paragraph S.1.12. The Committee also modified the proposal to clarify what are acceptable manual weight entries for point-of-sale systems and that the application in paragraph S.1.12. is effective on January 1, 2004 for manual net weight entries. However, the Committee may wish to consider keeping the original effective date of January 1, 1993 for simplicity since manual gross and net weight entries already occur and both entries would now be acceptable. The Committee believes these modifications provide the flexibility grocers need to make manual weight entries while there are sufficient safeguards to prevent fraudulent use of the feature.

For more background information, refer to the 2002 S&T Final Report.

320-2 V S.1.2.3. Prescription Scale with a Counting Feature, Table S.6.3.b. Note 13, S.6.6. Counting Feature Minimum Piece Weight and Number of Pieces, S.2.5.3. Class I and Class II Prescription Scales with a Counting Feature, Table 3 Parameters for Accuracy Classes Footnote 2, N.1.10. Counting Feature Test, T.N.3.10. Prescription Scales with a Counting Feature,UR.3.11. Recommended Minimum Count, UR.3.5. Special Designs, and Footnote 5

Source: Western Weights and Measures Association (WWMA). (This item originated from the Southern Weights and Measures Association and first appeared on the Committee's 2002 agenda as Developing Item 360-3, Appendix A. The submitter of the item, the WWMA, believes the proposal is ready for national review.)

Recommendation: McKesson Automated Prescription Systems along with NIST Weights and Measures Division and the S&T Committee developed an alternate proposal. Add new paragraphs S.1.2.3. Prescription Scale with a Counting Feature, S.6.6 Counting Feature Minimum Piece Weight, S.2.5.3. Class I and Class II Prescription Scales with a

Counting Feature, N.1.10. Counting Feature Test, T.N.3.10. Prescription Scales with a Counting Feature, and UR.3.11. Recommended Minimum Count as follows:

S.1.2.3. Prescription Scale with a Counting Feature. - A Class I or Class II prescription scale with an operational counting feature shall not calculate a piece weight or total count unless the following conditions are met:

(a) minimum individual piece weight is greater than or equal to 3 e,
(b) minimum sample weight is greater than or equal to 20 e, and
(c) minimum sample size is greater than or equal 10 pieces

S.2.5.3. Class I and Class II Prescription Scales with a Counting Feature. – A prescription scale, Class I or Class II, shall indicate to the operator when the piece weight computation is complete by a stable display of the quantity placed on the load receiving element.

S.6.6. Counting Feature Minimum Piece Weight and Number of Pieces. – A Class I or Class II prescription scale with an operational counting feature shall be marked with the minimum piece weight and minimum number of pieces used to establish an individual piece count.

N.1.10. Counting Feature Test. – A test of the counting function shall be conducted on all Class I and Class II prescription scales having an active counting feature. The test should verify that the scale will not accept a sample with less than either the minimum sample piece count or the minimum sample weight. Counting feature accuracy should be verified at a minimum of two test loads. Verification of the count calculations shall be based upon the weight indication of the test load.

T.N.3.10. Prescription Scales with a Counting Feature. – In addition to Table 6 Maintenance Tolerances (for weight), the indicated piece count value computed by a Class I or Class II prescription scale counting feature shall comply to within the tolerances in Table T.N.3.10. Maintenance and acceptance tolerances are the same.

Table T.N.3.10.
Maintenance and Acceptance Tolerances
in Excess and in Deficiency for Count

Indication of Count	Tolerance (piece count)
0 to 100	0
101 to 200	1
201 or more	0.5 %

UR.3.11. Recommended Minimum Count. – A prescription scale with an operational counting feature shall be used to count a quantity of 10 (at a minimum of 30 e) or more pieces.

Modify Table S.6.3.b. Note 13, Table 3 Parameters for Accuracy Classes Footnote 2, paragraph UR.3.5. Special Designs, and Footnote 5 as follows:

13. A scale designed for a special application rather than general use shall be conspicuously marked with suitable words visible to the operator and customer restricting its use to that application, e.g., postal scale, prepack scale, weight classifier, etc.* When a scale is installed with an operational counting feature, the scale shall be marked on both the operator and customer side with the statement "The counting feature is not legal for trade." Note: The "not legal for trade" marking is not required on a Class I or Class II prescription scale for which an NTEP Certificate of Conformance has been issue. The Certificate must specifically

include a counting feature that has been evaluated and approved. (See paragraph UR.3.5 and Footnote 5.)
[*Nonretroactive as of January 1, 1986]

Table 3 Parameters for Accuracy Classes
[2] A scale marked For prescription weighing only may have a verification scale division (e) not less than 0.01 g.

UR.3.5. Special Designs. - A scale designed and marked for a special application (such as a prepackaging scale or prescription scale with a counting feature) shall not be used for other than its intended purpose[5].

[5]Prepackaging scales and prescription scales with a counting feature (and other commercial devices) used for putting up packages in advance of sale are acceptable for use in commerce if all appropriate provisions of Handbook 44 are met. Users of such devices must be alert to the legal requirements relating to the declaration of quantity on a package. Such requirements are to the effect that, on the average, the contents of the individual packages of a particular commodity comprising a lot, shipment, or delivery must contain at least the quantity declared on the label. The fact that a prepackaging scale may overregister, but within established tolerances, and is approved for commercial service is not a legal justification for packages to contain, on the average, less than the labeled quantity.

Discussion: The WWMA proposed that the counting by weight feature on prescription scales should be recognized by NIST Handbook 44. The WWMA worked to develop a proposal based on the following input from prescription scale manufacturers: (1) there is a high level of regulatory oversight by the U.S. Food and Drug Administration (FDA) to ensure that prescription drug dosages are uniform, unlike other commodities sold by count based on weight, (2) pharmacists are trained professionals in search of an accurate method to dispense pills, and (3) device technology provides greater accuracy for filling containers when counting by weight rather than by hand. The WWMA recommended this application only for prescription scales because of the controls in place for pill dosages. The WWMA recognized that Handbook 44 must be modified to permit a counting feature for prescription scales and further work is needed to ensure appropriate test procedures are available. The WWMA indicated that the counting feature is suitable only for prescription scale applications when the device and the counting feature are covered on an NTEP Certificate of Conformance. The WWMA received documents from Stan Jankowski (McKesson Automated Prescription Systems) that contain the following (1) establishing piece weight data with reference weight, (2) expanding the reference weight data (optional algorithm for prescription scale program), (3) Recommended Characteristics for a Prescription Scale, (4) Accuracy Test for Prescription Scale Counting Feature, and (5) Two Methods for Verifying Counting Accuracy (see Appendix A for the documents provided by McKesson's representative). The WWMA encouraged the submitter of the proposal to work with parties such as NTEP, NIST, and the States to make any changes necessary to the proposed test procedures so that they adequately address Handbook 44 requirements.

The Southern Weights and Measures Association (SWMA) reviewed the WWMA proposal to remove the requirement to label operational counting features not legal for trade for NTEP approved prescription scales, but due to time constraints was not able to study the corresponding documents prepared by Mr. Jankowski. The SWMA recommended the type evaluation and field test procedures developed by Mr. Jankowski need to include tolerances and require further development. The SWMA recommended the proposal move forward as an information item until all work is complete on the procedures.

Past NCWM discussions about the counting feature focused on variability in the size of individual items, compliance with device performance tolerances, and the individual piece weight unit having a higher resolution than the displayed scale division (d). The initial WWMA proposal included language to eliminate labeling requirements for the counting feature on prescription scales from Table S.6.3.b Note 13 and preliminary test procedures, but did not include language for accuracy requirements or modifying the notes section to specify test procedures. These issues and others such as the appropriate standards and influence factors must be considered when examining new test procedures.

The Committee agreed that the information provided by the WWMA on prescription scales with a counting feature (see Appendix A) is a good start at recognizing that feature. The proposed procedures were supported as metrologically sound

by the Scale Manufacturers Association. However, the proposal to only modify Note 13 did not include necessary NIST Handbook 44 specifications, test procedures (influence factors, appropriate standards, etc.) for the counting feature.

At the Committee's recommendation, the proposal to modify Note 13 was reworked. The Committee reviewed the alternate proposal shown below to add new specifications for marking the prescription scale with its internal resolution and how the count feature must function.

> S.X.X. Pharmacy Scales (Scales used in pharmacy applications). A pharmacy scale installed with an operational counting feature shall be marked with the value of the internal scale division used internally for counting purposes.
>
> S.X.X. Pharmacy Counting Scale Divisions. A pharmacy counting scale shall not count when the scale calculated individual piece weight is less than 30 counting (internal) scale divisions.

The Committee believed that the specifications were also a good start at Handbook 44 requirements for Class II prescription scale counting features. However, Note 13 still required modification because the current wording prohibits the counting feature. The Committee made the proposed specifications a voting item with the stipulation that the original submitter and other prescription scale manufacturers complete their work with the weights and measures community to fully develop Handbook 44 requirements that adequately address the counting feature on Class II prescription scales, prior to the 2003 NCWM Annual Meeting.

In response to the Committee's request for comprehensive Handbook 44 language to address the counting feature, McKesson Automated Prescription Systems along with NIST Weights and Measures Division and the S&T Committee developed an alternate proposal that is shown in the recommendation above.

The proposed requirements were developed to ensure that the counting feature functioned properly, did not facilitate fraud, and could be verified at the field level. At this point, only Class I or Class II scale technology has sufficient resolution to determine piece weight and use that information as the basis for computing pill count to fill prescriptions. The relationship of the scale division (d) to the verification scale division (e) is already established in paragraph S.1.2.2.1. Class I and II Scales and Dynamic Monorail Scales, where $d < e \# 10\ d$. The limits on the value of d and e was considered in the development of proposal. There is also sufficient internal resolution in Class I and II digital scales to ensure accurate piece weight measurement when d equals e. However, internal resolution cannot be determined by the scale user or customer and is therefore not part of the proposed equation used to verify accuracy of the counting feature in paragraph S.1.2.3. Table 3 Parameters for Accuracy Classes Footnote 2 was modified to eliminate any confusion about the relationship of d and e for Class III scales used in a prescription application. The scale should not function when the conditions proposed in paragraph S.1.2.3. for establishing minimum piece weight, sample weight, and piece count are not met. Class I and Class II prescription scales used commercially to establish quantity must meet a tolerance for count. Packages filled through a Class I or Class II prescription scale with a counting feature that complies with all proposed Handbook 44 requirements must also comply with all other quantity and labeling requirements.

The Technical Advisors were asked to provide an example of how paragraph S.1.2.3. Prescription Scale with a Counting Feature would apply in the selection and use of a prescription scale. This example is based on a Class II prescription scale with a capacity of 500 g, where e = 0.01 g; d = 0.001 g; n_{max} = 50 000 and S.1.2.3. would apply as follows:

All requirements in subparagraphs (a) through (c) must be met;

(a) the minimum pill weight must be greater than or equal to 0.03 g (30 mg),
(b) the minimum sample weight used to establish a piece weight count must be greater than or equal to 0.2 g (200 mg), and
(c) the minimum number of pieces in a sample used to establish a piece weight count must be greater than or equal to 10 pills

A field examination procedure based on the proposed Handbook 44 requirements is needed for weights and measures officials. The following new test procedure was drafted for Examination Procedure Outline Number 1, Retail Computing Scales:

14. Test count feature for Class II prescription scales. Verify the count accuracy at least two points.

Place a load equivalent to 19e on the load receiving element and enter a sample count of 10. The device should not accept the entry.

Place a load equivalent to 20e on the load receiving element and enter a sample count of 9. The device should not accept the entry.

Place a load equivalent to 20e on the load receiving element and enter a sample count of 10. The device should accept the entry. Then place a load equivalent to 200e on the load receiving element. Verify that the total count is accurate.

Place a load equivalent to 200e on the load receiving element and enter a sample count of 10. The device should accept the entry. Then place a load equivalent to 4000e on the load receiving element. Verify that the total count is accurate.

The Committee asks for input from the Food and Drug Administration, U.S. Pharmacopeia, and representatives from the pharmaceutical industry on the proposal. To date, one scale manufacturer has indicated some concern about the variability in the pill formulation process and the effect on individual pill weight.

320-3 V S.6.4. Railway Track Scales

Source: Central Weights and Measures Association (CWMA)

Recommendation: Modify paragraph S.6.4. in the Scales Code as follows:

S.6.4. Railway Track Scales. – A railway track scale shall be marked with the maximum capacity of each section of the load-receiving element of the scale. Such marking shall be accurately and conspicuously presented on, or adjacent to, the identification or nomenclature plate that is attached to the indicating element of the scale. ~~***The nominal capacity of a scale with more than two sections shall not exceed twice its rated section capacity. The nominal capacity of a two-section scale shall not exceed its rated section capacity*** *[*]*~~**.** ***The marked nominal capacity shall not exceed the sectional capacity (SC) multiplied by the number of sections (N) of the scale minus 0.5 sections. The formula is stated as Nominal Capacity ≠ SC x (N - 0.5)*.***

[*Nonretroactive as of January 1, 200~~2~~4]

Discussion: In 2001, paragraph S.6.4. was modified to specify that the maximum nominal capacity for railway track scales with more than two sections must not exceed twice the marked section capacity and the nominal capacity for railway track scales with two sections must not exceed the marked section capacity. The CWMA finds that the marked nominal capacity required in paragraph S.6.4. is exceeded when railcars are pushed and placed on the scale for weighing. Systems monitor and record all weighments, which includes all instances where loads exceed the marked nominal capacity (except when total platform load is in excess of 105 percent of scale capacity). The proposal permits a greater nominal capacity that is based on the section capacity multiplied by the number of sections minus 0.5 sections, which CWMA believes is consistent with the nominal capacity specifications for modular vehicle scales.

Systems Associates Inc. indicates that railway track scales are designed to meet American Railway Engineering Maintenance of Way Association and Cooper E-80 specifications as specified by the servicing railroad. System Associates Inc. indicates that modular railway track scales based on Cooper E-80 specifications can withstand loads far greater than the marked nominal capacity limits in paragraph S.6.4. The length of scales fabricated from multiple modules is restricted because of nominal capacity limitations specified in current paragraph S.6.4.

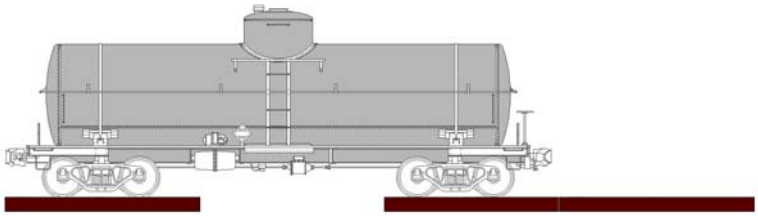
Systems Associates Inc. provided the examples below to demonstrate railway track scale loading, where railcar loads exceed nominal scale capacity limits specified in paragraph S.6.4. The modular railway track scale typically uses 100 000 lb load cells and has a 170 000 lb section capacity. A change to load cell capacity to meet the weight of coupled railcars might require modifications to the scale design and require re-evaluation by NTEP. Railcars are uncoupled at

both ends to obtain a true net weight and ensure there is no coupler interaction or weight transfer. The terms used in Examples A through C that are not in Handbook 44 are defined below:

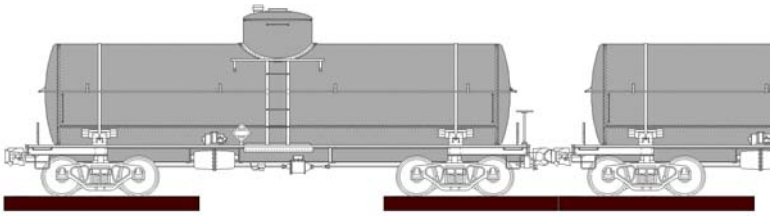
single scale – A single module having a 12 ft span that is designed to support three 80 000 lb axles on five foot centers.
double scale – A single module having a 25 ft to 26 ft span that is designed to support four 80 000 lb axles on five foot centers.
truck – swiveling framework of wheels located at each end of the railcar.

Examples of Railway Track Scale Loading

A - A Short Railcar on Single-Double scale

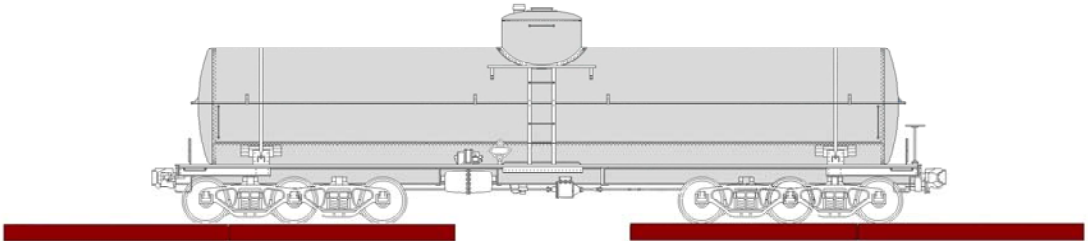


- A short railcar is spotted or placed into position for weighing on a single-double combination scale
- Each truck weighs 131 500 lb for a gross railcar weight of 263 000 lb
- The gross railcar weight does not exceed the nominal capacity of 340 000 lb



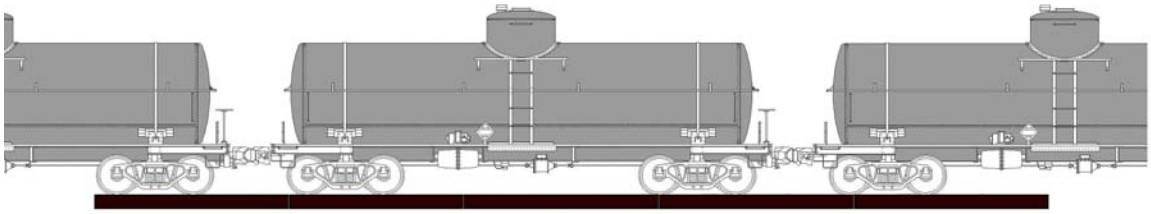
- The next car recouples to push the weighed railcar off the scale
- Each of the three trucks weighs 131 500 lb for a gross weight of 394 500 lb
- With 340 000 lb capacity, the scale is 54 500 lb overloaded under normal traffic
- The design load capacity (per railroad requirements) of this scale is 560 000 lb
- A nominal capacity of 400 000 lb would be acceptable in most applications

B - Six Axle Car on a Double-Double Scale



- Six axle railcar is spotted for weighing on a double-double combination scale
- Each truck weighs 192 000 lb for a gross weight of 384 000 lb
- With a 340 000 lb nominal capacity, this scale is overloaded by 44 000 lb
- The design load capacity of this scale (per railroad requirements) is 640 000 lb
- A nominal capacity of 600 000 lb would be acceptable in most applications

C - Railcars Moving on a 93-ft Modular Scale



- Railcars are moving across a 93 foot scale with seven 12 foot modules
- Each truck weighs 131 500 lb for a gross weight of 526 000 lb
- With a 340 000 lb nominal capacity, this scale is overloaded by 186 000 lb
- The design load capacity of this scale (per railroad requirements) is 1 044 000 lb
- A nominal capacity of 600 000 lb would be acceptable in most applications

The Committee acknowledges that overloading of scales does occur, for example, when locomotives are driven across scales. The overloading of scales is not a problem for scales that can take the overload. NIST Handbook 44 specifies that a scale cannot indicate more than 105 percent of scale capacity. Additionally, the scale should be suitable for a particular use with respect to its design, which includes but is not limited to its weighing capacity.

The Committee made changes to the formula to align the formula with similar applications in Handbook 44 and in response to a request from the submitter. The Committee modified the formula proposal to require a nominal capacity that is less than or equal to the section capacity multiplied by the number of scale sections minus 0.5 sections. The Committee also heard that there may be instances where coupled railway cars are being statically weighed and recommends that a user requirement may be needed to resolve this enforcement issue.

320-4 V Appendix D; Definition of Counter Scale

Source: National Type Evaluation Technical Committee (NTETC) Weighing Sector

Recommendation: Modify the definition of "counter scale" as follows:

> **counter scale. ~~One~~ A scale that, by reason of its size, arrangement of parts, and ~~moderate~~ with a nominal capacity no greater than 100 kg (220 lb), is adapted for use on a counter or bench. Sometimes called "bench scale."**

Discussion: There are some questions as to classifying certain scales as bench/counter scales or classifying them as floor scales. This confusion has lead officials to perform different shift tests on the same device. In some instances, the shift tests were based on the requirements in NIST Handbook 44 paragraph N.1.3.1. Bench or Counter Scales, which describes test load positions for bench/counter. In other instances, paragraph N.1.3.8. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers which addresses test load positions for other (platform) scales was applied to the same device model when it was classified as a floor scale.

Currently, Handbook 44 requires that bench/counter scale shift tests are conducted with a half capacity test load centered successively at four points equidistant between the center and the front, left, back and the right edges of the load-receiving element (see paragraph N.1.3.1.). Shift tests on other types of platform scales are conducted with one-half capacity test load centered, as nearly as possible, successively at the center of each quadrant (see paragraph N.1.3.8.). Several manufacturers have indicated that it is an unfair test to place one-quarter scale capacity on the corners of a single load cell scale as compared to placing one-quarter scale capacity in the corners of a scale with four load supports.

Additionally, Handbook 44 prescribes different requirements for the maximum loads that can be rezeroed in paragraph S.2.1.3. Scales Equipped with an Automatic Zero-Setting Mechanism for bench/counter scales (0.6 scale division) and for all other scales (1.0 scale division).

The NTETC Weighing Sector recommended a proposal to modify paragraphs N.1.3.1. and N.1.3.8. and revise the current definition of counter scale to distinguish bench/counter scale from floor scale applications based on the number of platform supports and the device's nominal capacity rating. The Weighing Sector recommended a capacity limit of 100 kg for bench/counter scales since many shipping scales in commercial use on business counters or elevated conveyors have a nominal capacity of 100 lb to 200 lb and 100 kg (220 lb) is consistent with capacity limits set by Measurement Canada.

The Southern Weights and Measures Association (SWMA) agreed with limiting the capacity of a bench scale to 100 kg (220 lb); however, the SWMA did not concur with the proposed changes to paragraphs N.1.3.1. and N.1.3.8.

The Scale Manufacturers Association (SMA) supported a recommendation to modify the definition of "counter scale." However, the SMA could support only limited changes to paragraphs N.1.3.1. and N.1.3.8. to specify the conditions for shift tests on multiple platform supports of bench and counter scales and test loads placed on multiple points for all other scales with a single platform support.

The Committee recognizes that the Weighing Sector's proposal was intended to align the U.S. and Measurement Canada's shift test procedure that are based on the number of load supports. The Committee agreed with comments from industry and weights and measures officials that paragraphs N.1.3.1. Bench or Counter Scales and N.1.3.8. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers adequately address shift test procedures and any change would create confusion. The Committee concurs with comments that the definition of counter scale needs to be modified. However, the Committee decided to amend the definition for clarity only and to include a 100 kg limit on the nominal capacity of counter scale.

320-5 V N.1.3.4. Vehicle Scales, Axle-Load Scales, and Livestock Scales With More Than Two Sections, N.1.3.4.1. Vehicle Scales, Axle-Load Scales, and Combination Vehicle/Livestock Scales, N.1.3.4.2. Prescribed Test Pattern and Test Loads for Livestock Scales and Combination Vehicle/Livestock Scales With More Than Two Sections and N.1.3.8. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers

(Carryover Item 320-1B was separated into two parts, Items 320-5 and 320-9, after the 2002 NCWM Annual Meeting to facilitate review of the issues.)

Source: Carryover Item 320-1B. (This item originated from the National Type Evaluation Technical Committee (NTETC) Weighing Sector and first appeared on the Committee's Agenda in 2001 as Item 320-4.)

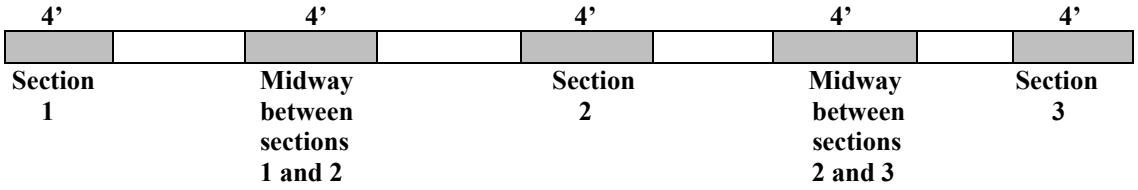
Recommendation: Modify paragraphs N.1.3.4. and N.1.3.4.1. as follows:

N.1.3.4. Vehicle Scales, Axle-Load Scales, and Livestock Scales ~~With More Than Two Sections~~

N.1.3.4.1. Vehicle Scales, Axle-Load Scales, and Combination Vehicle/Livestock Scales –

(a) Minimum Shift Test. At least one shift test shall be conducted with a minimum test load of 12.5 % of scale capacity and may be performed anywhere on the load-receiving element using the prescribed test patterns and maximum test loads specified below. ~~(Two-section livestock scales shall be tested consistent with N.1.3.8.)~~ (Combination Vehicle/Livestock scales shall also be tested consistent with N.1.3.4.2.)

~~(a~~b) Prescribed Test Pattern and Loading for Vehicle and Axle-Load Scales and Combination Vehicle/Livestock Scales. The normal prescribed test pattern shall be an area of 1.2 m (4 ft) in length and 3.0 m (10 ft) in width or the width of the scale platform, whichever is less. Multiple test patterns may be utilized when loaded in accordance with Paragraph ~~(b)~~ (c), (d), or (e) as applicable.



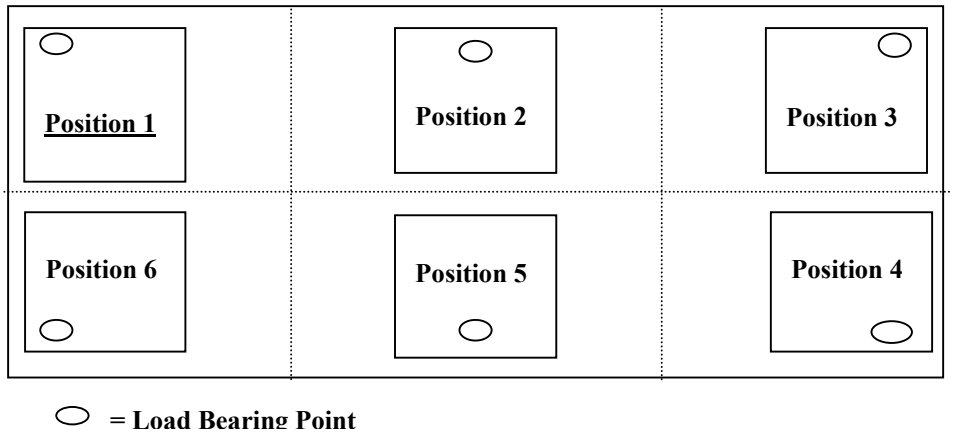
(~~b~~c)~~Maximum~~ Loading Precautions *for Vehicle, Axle-Load Scale, and Combination Vehicle/Livestock Scales*. When loading the scale for testing, one side of the test pattern shall be loaded to no more than half of the concentrated load capacity or test load before loading the other side. The area covered by the test load may be less than 1.2 m (4 ft) *x 3.0 m (10 ft) or* the width of the scale *platform whichever is less*; for test patterns less than 1.2 m (4 ft) in length the maximum loading shall meet the formula: [(wheel base of test cart or length of test load divided by 48 in) x 0.9 x CLC]. The maximum test load applied to each test pattern shall not exceed the concentrated load capacity of the scale. When the test pattern exceeds 1.2 m (4 ft), the maximum test load applied shall not exceed the concentrated load capacity times the largest "r" factor in Table UR.3.2.1. for the length of the area covered by the test load. For weighing elements installed prior to January 1, 1989, the rated section capacity may be substituted for concentrated load capacity to determine maximum loading. An example of a possible test pattern is shown ~~below~~ above.

(~~c~~d) Multiple Pattern Loading. To test the nominal capacity, multiple patterns may be simultaneously loaded in a manner consistent with the method of use.

(~~d~~e) Other Designs. Special design scales and those that are wider than 3.7 m (12 ft) shall be tested in a manner consistent with the method of use but following the principles described above.

Add new paragraph N.1.3.4.2. and associated diagram as follows:

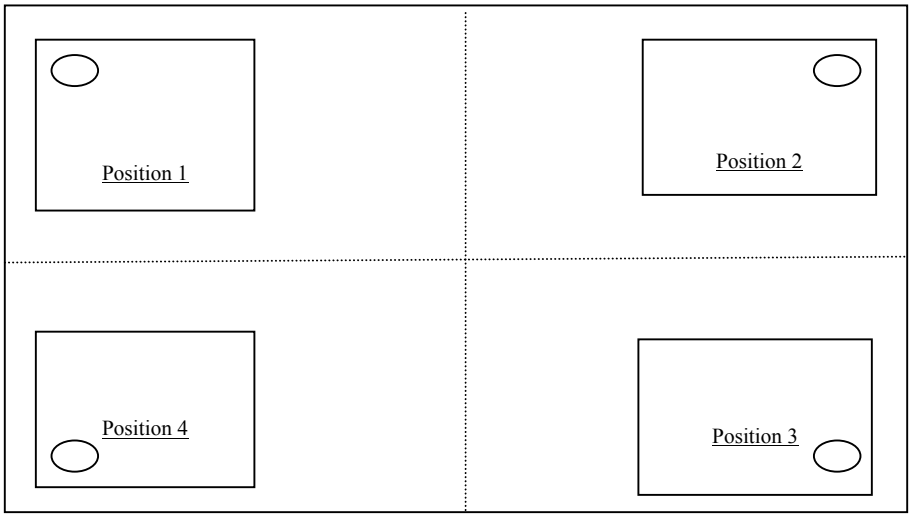
N.1.3.4.2. Prescribed Test Pattern and Test Loads for Livestock Scales with More Than Two Sections and Combination Vehicle/Livestock Scales. A minimum test load of 5000 kg (10 000 lb) or one-half of the rated section capacity, whichever is less, shall be placed, as nearly as possible, successively over each main load support as shown in the diagram below. For livestock scales manufactured between January 1, 1989, and January 1, 2003, the required loading shall be no greater than one-half CLC. (Two-section livestock scales shall be tested consistent with N.1.3.8.)



Modify paragraph N.1.3.8. as follows:

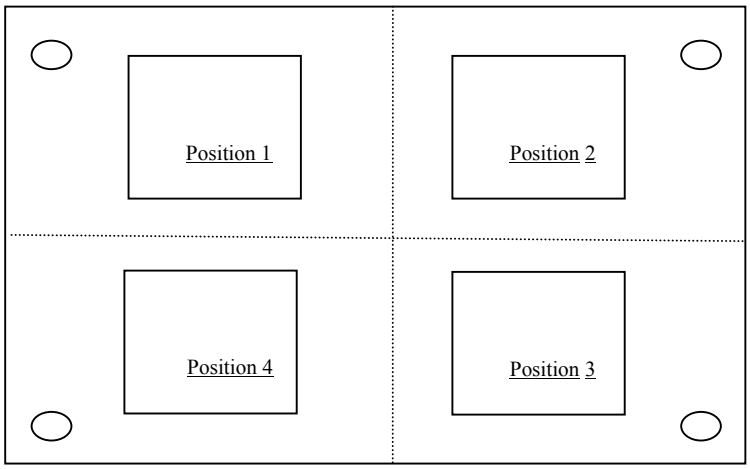
N.1.3.8. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers. – A shift test shall be conducted using the following prescribed test loads and test patterns. ~~with a half-capacity test load centered, as nearly as possible, successively at the center of each quarter of the load-receiving element, or with a quarter-capacity test load centered, as nearly as possible, successively over each main load support.~~ For livestock scales the shift test load shall not exceed one-half the rated section capacity.

(a) A shift test load shall be conducted using a one-quarter nominal capacity test load centered as nearly as possible, successively over each main load support as shown in the diagram below, or



= **Load Bearing Point**

(b) A shift test load shall be conducted using a one-half nominal capacity test load centered as nearly as possible, successively at the center of each quarter of the load-receiving element as shown in the diagram below.



= **Load Bearing Point**

Modify Table S.6.3.a. Marking Requirements Note 22 as follows:

> ***22. Combination vehicle/livestock scales must be marked with both the CLC for vehicle weighing and the section capacity for livestock weighing. All other requirements relative to these markings will apply.***
> ***[Nonretroactive as of January 1, 2003.]***
>
> ***Note: The marked section capacity for livestock weighing may be less than the marked CLC for vehicle weighing.***

Discussion: In 2001, the Committee considered language that prescribed the appropriate test load patterns, the maximum test load, and capacity ratings for safe and adequate test of a device's performance in vehicle and livestock scale applications. The 2001 proposal also included language to modify the definition of concentrated load capacity (CLC). In 2002, the Committee agreed to a recommendation that places in Handbook 44 the shift tests and test load patterns currently in use when testing livestock and vehicle scales. The 2002 proposal did not receive the majority vote necessary to modify requirements in NIST Handbook 44. The proposal was returned to the Committee. The proposal to modify the definition of concentrated load capacity to eliminate any reference to livestock scales now appears as agenda item 320-9.

At its 2002 Interim Meeting, the Northeastern Weights and Measures Association recommended that the proposal remain informational to allow sufficient time to address the concerns expressed by the SMA.

The Scale Manufacturers Association (SMA) supported the proposal to add new paragraph N.1.3.4.2. and modify Table S.6.3.b. Note 22 shown in the recommendation above.

At its 2002 meeting, the Weighing Sector agreed to support a separate proposal to make the definition for concentrated load capacity a separate agenda item from the item to establish test patterns and test loads for livestock scales. The Weighing Sector agreed with the Central Weights and Measures Association recommendation that a test load of 12.5 percent of scale capacity, not to exceed one-half section capacity, is more than adequate to test a main load support. The Sector noted that the test load of 12.5 percent of scale capacity provides an adequate test of the performance of the load support and also addresses safety concerns that might arise when stacking weights. The Weighing Sector proposed alternate language for the new paragraph N.1.3.4.2. and included the diagram shown in the recommendation above that specifies a minimum test load of 10 000 lb to facilitate the safe application of test weights while applying a load that more closely simulates the potential concentration of livestock in the corner of the scale. The language in the Weighing Sector proposal is intended to permit weights and measures officials and NTEP laboratories to conduct shift tests up to 12.5 percent of scale capacity.

The Weighing Sector believes that testing of main load supports more accurately reflects the actual usage of livestock scales. The Weighing Sector added broken lines to the test pattern diagram in paragraph N.1.3.4.2. to indicate that test loads should not be centered over the main load bearing points.

The Committee believes the recommendations above includes language that addresses the test load patterns, the maximum test load, and capacity ratings for safe and adequate test of a device's performance in vehicle and livestock scale applications. The Committee decided that the Weighing Sector's proposal for new paragraph N.1.3.4.2. and associated diagram shown in the recommendation above were more appropriate guidelines for the test load and test pattern for livestock scales with more than two sections and combination vehicle/livestock scales. The Committee also agreed with the WWMA's recommendation to add a note to Table S.6.3.a Note 22 as shown in the recommendation above.

For additional background on this item, refer to the 2001 and 2002 S&T Final Reports.

320-6 W N.1.3.8. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers, T.N.3.4. Crane and Hopper (Other than Grain Hopper) Scales, Table 3 Parameters for Accuracy Classes; Footnote 3, Table 7a. Typical Class or Type of Device for Weighing Operations, and Appendix D; Definition of Crane Scale and Hanging Scale

Source: National Type Evaluation Technical Committee (NTETC) Weighing Sector

Discussion: The Committee considered a proposal to modify paragraphs N.1.3.8. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers and T.N.3.4. Crane and Hopper (Other than Grain Hopper) Scales, Table 3 Parameters for Accuracy Classes Footnote 3, and Table 7a. Typical Class or Type of Device for Weighing Operations, and Table 7b. Applicable to Devices not Marked with a Class Designation as follows:

> N.1.3.8. All Other Scales Except ~~Crane Scales~~, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers. – A shift test shall be conducted with a half-capacity test load centered, as nearly as possible, successively at the center of each quarter of the load-receiving element, or with a quarter-capacity test load centered, as nearly as possible, successively over each main load support.
>
> T.N.3.4. ~~Crane~~ Class III L Hanging and Hopper (Other than Grain Hopper) Scales. – The maintenance and acceptance tolerances shall be as specified in T.N.3.1. and T.N.3.2. for Class III L, except that the tolerance for ~~crane~~ Class III L hanging and construction materials hopper scales shall not be less than 1d or 0.1 percent of the scale capacity, whichever is less.
>
> [3] The value of a scale division for ~~crane~~ Class III L hanging and hopper (other than grain hopper) scales shall be not less than 0.2 kg (0.5 lb). The minimum number of scale divisions shall be not less than 1 000.

Table 7a.
Typical Class or Type of Device for Weighing Operations

Class	Weighing Application or Scale Type
I	Precision laboratory weighing
II	Laboratory weighing, precious metals and gem weighing, grain test scales
III	All commercial weighing not otherwise specified, grain test scales, retail precious metals and semi-precious gem weighing, animal scales, postal scales, scales used to determine laundry charges, hanging, and vehicle on-board weighing systems
III L	Vehicle, axle-load, livestock, railway track scales, ~~crane~~ hanging, hopper (other than grain hopper) scales, and vehicle on-board weighing systems
IIII	Wheel-load weighers and portable axle-load weighers used for highway weight enforcement

Note: A scale with a higher accuracy class than that specified as "typical" may be used.

Table 7b. Applicable to Devices not Marked with a Class Designation	
Scale Type or Design	Maximum Value of d
Retail Food Scales, capacity less than or equal to 50 lb	1 ounce
Animal Scales	1 pound
Grain Hopper Scales Capacity up to and incl. 50 000 lb Capacity over 50 000 lb	 10 pounds (not greater than 0.05 % of capacity) 20 pounds
~~Crane~~ Hanging Scales – Capacity 5000 lb and over	Not greater than 0.2 % of capacity
Vehicle and Axle-Load Scales Used in Combination Capacity up to and including 200 000 lb Capacity over 200 000 lb	 20 pounds 50 pounds
Railway Track Scales With weighbeams Automatic indicating	 20 pounds 100 pounds
Scales with capacities greater than 500 lb except otherwise specified	0.1 % capacity (but not greater than 50 lb)
Wheel-Load Weighers	0.25 % capacity (but not greater than 50 lb)
Note: For scales not specified in this table, G-UR.1.1. and UR.1. apply.	

Delete the Appendix D; Definition of Crane Scale as follows:

> ~~crane scale. One with a nominal capacity of 5000 pounds or more designed to weigh loads while they are suspended freely from an overhead, track mounted crane.~~

Add the following new definition of "hanging scale" to Appendix D as follows:

> hanging scale. A scale designed to weigh loads while they are suspended from a hook on the scale or loads resting on a platter or platform that is suspended from the scale. Hanging scales may be any capacity and may be Class III or III L, whichever is appropriate for the intended use, as long as all parameters for the intended class are met. Sometimes called "crane scale."

The Weighing Sector reported that existing criteria for distinguishing hanging scale applications from crane scale applications are not clear and are inconsistent. Currently, the term "hanging scale" is not defined in NIST Handbook 44 although the term is cited in several requirements in the Scales Code.

The Weighing Sector noted that Handbook 44 Scales Code Table 3 Parameters for Accuracy Classes, Footnote 3 specifies that the minimum permissible capacity for a crane scale is 500 lb; however, the existing Handbook 44 definition states that a crane scale has a nominal capacity of 5000 lb or more. The Weighing Sector also noted there are also inconsistencies in the use of the term crane scale in Handbook 44 and NTEP Certificates of Conformance (CC). Several CCs were issued to families of electronic scales with capacities that range from 1000 lb to 50 000 lb, with hanging and crane scale designations.

The Weighing Sector agreed that the only difference in the installation of hanging scales and crane scales appears to be that hanging scales are suspended from fixed supports while crane scales are suspended from overhead, track-mounted cranes. However, some overhead, track-mounted scales might easily be suspended from other types of cranes or supporting structures. The Weighing Sector believes that the design of a scale's support structure (overhead crane, fixed support, etc.) should not be the factor that determines device type.

The Southern Weights and Measures Association recommended further study on how the proposals will impact existing devices.

The Scale Manufacturers Association (SMA) supports reducing the number of categories of weighing devices. However, the SMA opposes removing the term crane scale from the Scales Code without further discussion.

The Committee discussed the Weighing Sector's concern about the large list of terms used to identify various scale types and designs. The Committee questioned the existence of Class II hanging scales that may not be included in the proposed definition for hanging scale. The Committee believes that the Weighing Sector should explore other options to consolidate the terminology used to describe scale types and designs.

320-7 V T.N.8.3.1.(a) Power Supply, Voltage and Frequency

Source: National Type Evaluation Technical Committee (NTETC) Weighing Sector

Recommendation: Amend T.N.8.3.1.(a) Power Supply, Voltage and Frequency as follows:

> **(a) Weighing devices that operate using alternating current must perform within the conditions defined in paragraphs T.N.3. through T.N.7., inclusive, over the nominal line voltage with the tolerance –15 percent to +10 percent of the nominal, or the range as marked by the manufacturer. (Range takes precedence) ~~of 100 V to 130 V or 200 V to 250 V rms as appropriate, and over the frequency range of 59.5 Hz to~~ at 60 ~~..5~~ Hz.**

Discussion: NTEP Participating Laboratories reported an increase in the number of devices submitted for type evaluation with voltage ranges wider than the voltages listed in NIST Handbook 44 paragraph T.N.8.3.1. For example, a device might be marked with a voltage range of 80 V to 170 V. The Participating Laboratories believe that testing over the entire voltage range is not supported by language in paragraph T.N.8.3.1.

The NTETC Weighing Sector reviewed the Canadian and OIML voltage requirements. In the Canadian requirements for maximum and minimum specified voltage, devices may be marked with a nominal voltage of 117 V, 225 V, or other voltage. When a device is marked with a voltage range the midpoint is taken as the nominal voltage. The device is tested at !15 percent and +10 percent of the marked nominal voltage. Devices marked with a range are tested to the *greater* of !15 percent and +10 percent of the midpoint of the nominal voltage or the maximum and minimum indicated voltage range values. OIML R 76-1, Nonautomatic Weighing Instruments, Part 1: Metrological and Technical Requirements - Tests (Edition 1992 E) requires test of the device at –15 percent of the maximum marked voltage and +10 percent of the minimum marked voltage.

The Weighing Sector's proposal to modify paragraph T.N.8.3.1.(a) required tests over the marked voltage range rather than a specified voltage range. Performance tests would be conducted at the device's marked maximum voltage, minimum voltage, and nominal voltage (voltage value at the midpoint of the range).

The Weighing Sector also questioned whether performance tests during variations in frequency are appropriate. Currently, NTEP does not test for a change in line frequency of " 0.5 Hz because test equipment is very expensive. Manufacturers indicate that today's weighing devices are capable of performing over a much larger voltage and frequency range than specified in Handbook 44 because devices are equipped with one version of power supply that is suitable for the worldwide marketplace.

The SWMA believed its alternate language provided a requirement that harmonizes with OIML requirements.

The Committee reviewed the following alternate proposals to modify paragraph T.N.8.3.1.(a) submitted by the Weighing Sector and Southern Weights and Measures Association (SWMA), respectively.

> T.N.8.3.1.(a) Power Supply, Voltage and Frequency.
>
> (a) Weighing devices that operate using alternating current must perform within the conditions defined in paragraphs T.N.3. through T.N.7., inclusive, over the line voltage

range as marked ~~of 100 V to 130 V or 200 V to 250 V rms as appropriate, and over the frequency range of 59.5 Hz to~~ at 60~~.5~~ Hz.

or

T.N.8.3.1.(a) Power Supply, Voltage and Frequency.

Weighing devices that operate from a main power supply must perform within the conditions defined in paragraphs T.N.3. through T.N.7., inclusive if the power supply varies in voltage from –15 percent to + 10 percent of the value marked on the device. If a range of voltage is marked, the device shall operate within the conditions defined in paragraphs T.N.3. through T.N. 7., inclusive at a voltage of + 10 percent of the maximum voltage marked on the device and at a voltage of –15 percent of the minimum voltage marked on the device ~~using alternating current must perform within the conditions defined in paragraphs T.N.3. through T.N.7., inclusive, over the line voltage range of 100 V to 130 V or 200 V to 250 V rms as appropriate, and over the frequency range of 59.5 Hz to 60.5 Hz~~.

The Committee agreed that the SMA proposal shown in the recommendation above provided the clearest guidelines on the voltage and frequency for performance test.

320-8 W UR.1.6. Average Net Load; Class III Scales

Source: Carryover Item 320-3. (This item originated in the Central Weights and Measures Association (CWMA) and first appeared on the Committee's 2002 agenda.)

Background/Discussion: The Committee considered a proposal to add new paragraph UR.1.6. Average Net Load – Class III Scales and Table as follows:

UR.1.6. Average Net Load – Class III Scales. – To be suitable for its application, a Class III scale shall have a division such that the requirements of the following table are satisfied for the minimum and average loads weighed on the scale.

Range of Scale Capacities	*Average Net Load **
Capacities up to and including 1000 kg (2500 lb)	*Average net load $\geq$ 100d*
Capacities greater than 1000 kg (2500 lb)	*Average net load $\geq$ 500d*

[Nonretroactive as of January 1, 2003]

** See Table 8 for recommended minimum load.*

Device suitability for particular commercial applications is a recurrent issue on the S&T Agenda and generates many questions in the weights and measures community. The proposal was intended to incorporate guidelines into NIST Handbook 44 requirements that would assist business owners in the purchase of suitable equipment and to provide industry and weights and measures officials with a uniform method for assessing the suitability of a device in an application. The Committee discussed factors such as the size of the purchase, the size of the scale division, and the commodity price and how these factors affect the magnitude of scale error.

In 1992, the Committee considered a proposal from the CWMA to express the suitability requirements for scales as two separate formulae. Scales marked with an accuracy class would be have been required to satisfy a formula for the minimum net load and a formula for the average net load. Scales not marked with an accuracy class would have had to comply with Table 7b which specifies a maximum value of d for a particular scale type or design. The scale division value was dependent on the scale capacity. The value of d for scales with capacities from 5 lb to 2500 lb, inclusive, were allowed to be a larger percentage of the minimum net load and average net load than scales with capacities less than 5 lb and greater than 2500 lb.

In 1994, the NCWM adopted guidelines to determine the average net load of purchases on Class III scales. The average net load information was still necessary to evaluate the suitability of a scale for an application. However, the guidelines were not included in NIST Handbook 44 requirements, hence weights and measures officials find it difficult to enforce suitability requirements. Inconsistencies in the determination of a minimum load requirement for a device continue to be a concern to industry and weights and measures officials.

Regional weights and measures associations agreed that better criteria are needed to determine the suitability of a device. Several regional associations recommended making the proposal a developing item to allow time to develop criteria.

During its 2002 Interim Meeting, the CWMA reiterated its belief that weights and measures can obtain information about average net loads from the retailer. In instances where the retailer and weights and measures officials do not agree on the average net load, the burden of proof lies with the retailer. The CWMA also provided the following list of examples submitted by Nebraska which demonstrate how to determine the suitability of Class III scales used in specific applications.

CWMA Suitability Examples for
Average Net Load (ANL)

d – scale division
*NIST Handbook 44 specifies scale division "d" must be expressed in units of 1, 2, or 5

	Typical Application	Example	Formula*
1	Supermarket Checkstand	•Most transactions involve produce that weighs from 0.5 lb to 5 lb, with infrequent weighments above and below that range •The average net load is approximately 2 lb •Using the formula for a scale with a capacity up to 2500 lb: A division of 0.02 lb or less is suitable	d ≤ 1 % x ANL d ≤ 0.01 x 2 lb d ≤ 0.02 lb
2	Supermarket Deli Scale	•Most transactions involve weighments between 0.25 lb to 3 lb •The average net load is approximately 1 lb •Using the formula for a scale with a capacity up to 2500 lb: A division of 0.01 lb or less is suitable	d ≤ 1 % x ANL d ≤ 0.01 x 1 lb d ≤ 0.01 lb
3	Specialty Shop Scale – Shopping Mall (30 lb x 0.01 lb electronic scale)	•Most transactions involve weighments of coffee, tea, tobacco, spices, or chocolates between 0.12 lb (2 oz) to 1 lb •The average net load is approximately 0.5 lb •Using the formula for a scale with a capacity up to 2500 lb: A division of 0.005 lb or less is suitable, the scale in use is not suitable for this application	d ≤ 1 % x ANL d ≤ 0.01 x 0.5 lb d ≤ 0.005 lb
4	Hopper Scale	•The average net load is approximately 9500 lb •Using the formula for a scale with a capacity above 2500 lb: A division of 10 lb or less is suitable	d ≤ 2 % x ANL d ≤ 0.02 x 9500 lb d ≤ 19 lb * d is 10 lb
5	Platform Scale (500 lb x 4 oz scale for buying aluminum cans-new business)	•Weights and measures informs a business a device is suitable for weighments above 25 lb •However the average net load is approximately 5 lb •Using the formula for a scale with a capacity up to 2500 lb: A division of 0.05 lb or less is suitable	d ≤ 1 % x ANL d ≤ 0.01 x 5 lb d ≤ 0.05 lb

CWMA Suitability Examples for Average Net Load (ANL)

d – scale division
*NIST Handbook 44 specifies scale division "d" must be expressed in units of 1, 2, or 5

	Typical Application	Example	Formula*
6	Grain Scale	•Most weighments are used for a moisture test •The average net load is 250 g •Using the formula for a scale with a capacity up to 2500 lb: A division of 0.1 g is suitable, in fact a d ≤ 5 g is suitable	d ≤ 2 % x ANL d ≤ 0.02 x 250 g d ≤ 5 g
7	Other Scale	•Most weighments are of hog heads or sheep •The average net load is 200 lb •Using the formula for a scale with a capacity up to 2500 lb: A division of 2 lb or is suitable	d ≤ 1 % x ANL d ≤ 0.01 x 200 lb d ≤ 2 lb
8	Monorail Scale (packing house)	•Most weighments are of carcasses •The average net load is 180 lb •Using the formula for a scale with a capacity up to 2500 lb: A division of 1 lb or less is suitable	d ≤ 1 % x ANL d ≤ 0.01 x 180 lb d ≤ 1.8 lb

The Committee considered the CWMA's proposal to add new paragraph UR.1.6. Average Net Load – Class III Scales and Table to the Scales Code. The Committee acknowledges that guidelines to assist the scale user, service company, and weights and measures official in determining the suitability of a device for a weighing application are needed and long overdue. The Committee recommends that submitters of future proposals for such guidelines review Measurement Canada's table for minimum net loads. The Canadian table includes guidelines for the minimum net load for weighing applications based on the type of materials weighed. Each application has a minimum net load expressed as a multiple of the verification scale interval (e). The Committee finds that the proposal cannot be uniformly applied to all weighing applications it is intended to cover. Industry opposes the proposal citing that the concept is good, but the guidelines are unenforceable and subjective. Consequently, the Committee withdraws this item from its agenda.

For more background information, refer to the 1992 and 2002 S&T Final Reports.

320-9 V Appendix D; Definition for Concentrated Load Capacity (CLC); Dual Tandem Axle Capacity

(Carryover Item 320-1B was separated into two parts, Items 320-5 and 320-9, after the 2002 NCWM Annual Meeting to facilitate review of the issues.)

Source: Carryover Item 320-1B. (This item originated from the National Type Evaluation Technical Committee (NTETC) Weighing Sector and first appeared on the Committee's Agenda in 2001 as Item 320-4.)

Recommendation: Modify the definition of Concentrated Load Capacity in Appendix D as follows:

> **concentrated load capacity (CLC) (also referred to as Dual Tandem Axle Capacity (DTAC)). A capacity rating of a vehicle~~,~~ or axle-load~~, or livestock~~ scale, specified by the manufacturer, defining the maximum load ~~concentration~~ applied by a group of two axles with a centerline**

spaced 4 feet apart and an axle width of 8 feet for which the weighbridge is designed. ~~In the case of vehicle and axle-load scales, it is the maximum axle-load concentration (for a group of two axles with a centerline spaced 4 feet apart and an axle width of 8 feet) for which the weighbridge is designed as specified by the manufacturer.~~ The concentrated load capacity rating is for both test and use. [2.20]

Discussion: In July 2002, the NCWM considered language that prescribed the appropriate test load patterns, maximum test load, and capacity ratings for safe and adequate test of a device's performance in vehicle and livestock scale applications. The NCWM adopted requirements for the nominal capacity of livestock scales based on section capacity rather than concentrated load capacity. The NCWM also considered as part of the 2002 proposal, language developed by the Weighing Sector. The Weighing Sector's proposal was intended to modify the definition of concentrated load capacity (CLC) to eliminate any reference to livestock scales since CLC was intended to address the maximum load rating for a weighbridge based on a typical tandem axle vehicle's footprint rather than livestock loading patterns as follows:

concentrated load capacity (CLC). A capacity rating of a vehicle~~,~~ or axle-load ~~or livestock~~ scale, specified by the manufacturer, defining the maximum load ~~concentration~~ applied by a group of two axles with a centerline spaced 4 feet apart and an axle width of 8 feet for which the weighbridge is designed. ~~In the case of vehicle and axle load scales, it is the maximum axle load concentration (for a group of two axles with a centerline spaced 4 feet apart and an axle width of 8 feet) for which the weighbridge is designed as specified by the manufacturer.~~ The concentrated load capacity rating is for both test and use. [2.20]

The proposal to modify the definition of CLC did not receive the majority vote necessary to make changes to NIST Handbook 44. The item was returned to the Committee and now appears as two separate issues, Item 320-5 and Item 320-9.

The Western and Southern Weights and Measures Associations agreed to support an alternate proposal to change the definition of CLC as shown in the recommendation above. The regional associations noted that weighbridges are designed for a load applied by a group of two axles with a centerline spaced 4 feet apart and an axle width of 8 feet. The two (dual) axles are routinely referred to as a tandem axle. Industry representatives report that dual tandem axle capacity (DTAC) is cited in equipment literature rather than CLC because users are not familiar with CLC. However, some manufacturers declare a CLC based on the amount of test weight applied during a shift test which exceeds the weighbridge design load. The regional associations are concerned that manufacturers who declare different CLC and DTAC ratings do not recognize that CLC refers to dual axles or that the ratings might be misleading the buyer.

The Committee agreed to recommend the Western (WWMA) and Southern (SWMA) Weights and Measures Associations alternate definition of concentrated load capacity for adoption at the 2003 NCWM Annual Meeting. The alternate definition of CLC addresses concerns about the appropriate use of the term DTAC in reference to scale's rating as well as removes any reference to livestock scale applications. The Committee discussed that dual tandem axle vehicles are configured with two wheels on the end of the axle for a total of eight tires although it is possible for tandem axles with one wheel on each axle. However, dual tandem axle capacity and CLC are the same and to state any difference is misleading. CLC ratings allow the device user to compare the capacities of each device. The load pattern and capacity for a device is the same for dual tandem axle capacity and CLC. The device user cannot ask for a larger test pattern, if declaring either capacity rating (DTAC or CLC).

For more background information, refer to the 2001 and 2002 S&T Final Reports.

320-10A V Appendix D; Definition of Substitution Test and Substitution Test Load

(Item 320-10 was separated into three parts, Items 320-10A, 320-10B, and 320-10C to facilitate review of the issues.)

Source: Carryover Item 320-8 (This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 2000 agenda as Item 320-6.)

Recommendation: The Committee recommends that the following definitions for "substitution test" and "substitution test load" be added to NIST Handbook 44:

> **substitution test. - A scale testing process used to quantify the weight of unknown material or objects for use as a known test load.**
>
> **substitution test load. - The sum of the combination of field standard test weights and any other applied load used in the conduct of a test using substitution test methods.**

Discussion/Background: The substitution test procedures were developed in 1965 prior to the widespread use of electronic scales. Since 1999, the lack of a definition for the term "substitution test" has created much discussion and confusion about the meaning of the term "substitution load" and other related terms such as "strain load test," "build-up test," and "step test." Many discussions about "substitution tests" have focused on (1) uncertainties associated with repeating the procedure, (2) the effects of the environment on uncertainties, (3) the ability to bring the amount of substituted materials to the exact amount of known test weights, (4) the need to address operational differences in technology (mechanical vs. electronic) and device types in test procedures, and (5) keeping test procedures separate from definitions.

During the 2002 NCWM Interim Meeting, the Committee agreed that the definition of substitution test developed by Ross Andersen (New York Bureau of Weights and Measures) adequately described the test load and test procedure and relevant tolerances without being too restrictive or documenting the details for test procedures. The Committee also agreed with New York's proposed definition of test load which clarified that the term applies to the substitution process.

At the 2002 NCWM Annual Meeting, the Committee also reviewed a WMD recommendation to modify the current definition of "strain-load test" to be more consistent with Mr. Andersen's proposed definition of "substitution test" as follows:

> strain-load test. ~~The test of a scale beginning with the scale under load and applying known test weights to determine accuracy over a portion of the weighing range. The scale errors for a strain-load test are the errors observed for the known test loads only.~~ A scale testing procedure that uses a quantity of unknown material or objects in addition to known test weights in order to test a scale with a load greater than the known test weights. In this procedure, unknown material or objects are used to establish a reference load or tare to which known test weights are added. The tolerances to be applied to the change in indication of the unknown load to the sum of the indications for total unknown load and known test weights are based on the known test weights ~~load used for each error that is determined~~. Substitution test loads can be used in lieu of known test weights.

The proposal developed by Mr. Andersen was kept an information item to determine if there are acceptable limits for the variation between the scale indications for known test weight and the substitution load, and to eliminate any test procedures from the definition in favor of including the information in an examination procedure outline.

During its September 2002 Technical Conference, the Western Weights and Measures Association (WWMA) supported the definitions for substitution test, substitution test load, and strain load. The WWMA recommended that appropriate procedures be developed for using the substitution test method for mechanical and electronic devices and that information be included in an examination procedure outline (EPO)**.**

At its 2002 Interim Meeting, the CWMA developed a proposal for an alternate new definition of "substitution test" and to modify the current definition of "strain-load test" that eliminated all procedural language. The CWMA also proposed to eliminate any confusion between the terms substitution test and strain-load test by creating separate procedures and tolerances for each test method.

The Committee heard numerous comments from NCWM members who proposed alternate definitions, but were now in favor of the substitution test and substitution test load definitions, and separate test notes and tolerances for substitution test and strain-load test developed by the CWMA. The Committee found the CWMA proposal effectively separates procedural language from definitions thereby eliminating confusion on how to conduct the test procedures. The

Committee heard that Ross Andersen (New York) is also working on procedures that will allow officials to assess the uncertainty for specific scale installations and applications.

The Committee agreed to support CWMA's proposal as shown in the recommendation above. The Committee also split the proposal into three separate items, 320-10A, 320-10B, and 320-10C as recommended by the CWMA.

For additional background information on this item, refer to the 2000, 2001, and 2002 S&T Final Reports.

320-10B V N.1.X. Substitution Test and T.X. Tolerances for Substitution Test

(Item 320-10 was separated into three parts, Items 320-10A, 320-10B, and 320-10C to facilitate review of the issues.)

Source: Carryover Item 320-8 (This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 2000 agenda as Item 320-6.)

Recommendation: Add new paragraphs N.1.X. Substitution Test and T.X. Tolerances for Substitution Test to the NIST Handbook 44 Scales Code as follows:

> **N.1.X. Substitution Test. - In the substitution test process, the unknown material or objects are substituted for known test weights, or a combination of known test weights and previously quantified material or objects, using the scale under test as a comparator. Additional test weights or other known test loads may be added to the known test load to evaluate higher weight ranges on the scale.**
>
> **T.X. Tolerances for Substitution Test. - Tolerances are applied to the scale based on the entire known test load.**

Discussion: Since 1999, the Committee has discussed numerous proposals to define "substitution test" and related terms such as "strain-load test" to clarify any confusion about test methods for large capacity scales.

At its 2002 Interim Meeting, the CWMA developed a proposal for an alternate new definition of "substitution test" and to modify the current definition of "strain-load test" that eliminated all procedural language. The CWMA also proposed to eliminate any confusion between the terms substitution test and strain-load test by creating separate procedures and tolerances for each test method.

The Committee heard numerous comments from NCWM members who proposed alternate definitions, but were now in favor of the substitution test and substitution test load definitions and separate test notes and tolerances for substitution test and strain-load test developed by the CWMA. The Committee found the CWMA proposal effectively separates procedural language from definitions thereby eliminating confusion on how to conduct the test procedures. The Committee heard that Ross Andersen (New York) is also working on procedures that will allow officials to assess the uncertainty for specific scale installations and applications.

The Committee agreed to support CWMA's proposal as shown in the recommendation above. The Committee also split the proposal into three separate items, 320-10A, 320-10B, and 320-10C as recommended by the CWMA.

The background and rationale for this item are outlined in Item 320-10A

320-10C V N.1.X. Strain-Load Test and T.X. Tolerances for Strain-Load Test

(Item 320-10 was separated into three parts, Items 320-10A, 320-10B, and 320-10C to facilitate review of the issues.)

Source: Carryover Item 320-8 (This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 2000 agenda as Item 320-6.)

Recommendation: Add new paragraphs N.1.X. Strain-Load Test and T.X. Tolerances for Strain-Load Test to NIST Handbook 44 Scales Code as follows:

> **N.1.X. Strain-Load Test. - In the strain load test procedure, unknown material or objects are used to establish a reference load or tare to which known test weights or test loads are added.**
>
> **T.X. Tolerances for Strain-Load Test. - The tolerances to be applied to the scale are based on the change in indication of the unknown load, to the sum of the indications for total unknown load, and known test weights are based on the known test weights.**

Discussion: Since 1999, the Committee has discussed numerous proposals to define "substitution test" and related terms such as "strain-load test" to clarify any confusion about test methods for large capacity scales.

At its 2002 Interim Meeting, the CWMA developed a proposal to modify the current definition of "strain-load test" that eliminated all procedural language. The CWMA also proposed to eliminate any confusion between the terms substitution test and strain-load test by creating separate procedures and tolerances for each test method.

The Committee heard numerous comments from NCWM members who proposed alternate definitions, but were now in favor of the substitution test and substitution test load definitions and separate test notes and tolerances for substitution test and strain-load test developed by the CWMA. The Committee found the CWMA proposal effectively separates procedural language from definitions thereby eliminating confusion on how to conduct the test procedures. The Committee heard that Ross Andersen (New York) is also working on procedures that will allow officials to assess the uncertainty for specific scale installations and applications.

The Committee agreed to support CWMA's proposal as shown in the recommendation above. The Committee also split the proposal into three separate items, 320-10A, 320-10B, and 320-10C as recommended by the CWMA.

The background and rationale for this item are outlined in Item 320-10A

320-11 I N.1.3.4.1. Weight Carts

(This item first appeared on the Committee's 2003 agenda as Developing Item 360-3, Appendix B Item 1. The Committee changed the item's status to an information item because corresponding work to develop weight cart standards is nearing completion.)

Source: Northeastern Weights and Measures Association (NEWMA)

Recommendation: Add new paragraph N.1.3.4.1. to the Scales Code as follows:

> **N.1.3.4.1. Weight Carts. – Weight carts may be included as part of the minimum required test load required in N.1.3.4. provided that the mass value of the weight cart has been determined by weights and measures and is clearly marked thereon. Further, a certificate of calibration issued by the weights and measures jurisdiction that issued the weight certificate must be available at all times. Said certificate shall contain at a minimum the following information: date of calibration, name, model, and serial number of the weight cart, the minimum graduation of the scale used in the calibration of the weight cart, and the name of the jurisdiction and inspector or metrologist who determined the mass value.**

Discussion: This proposal is intended to modify the NIST Handbook 44 Scales Code to recognize the use of weight carts during a shift test. Guidelines for weight carts are not recognized in any current standards document. The Committee received a report on the status of NIST Handbook 105-8, "Specifications and Tolerances for Field Standard Weight Carts," which is scheduled for publication March 2003. The Committee encourages the weights and measures community to provide comments on the Handbook. The Scale Manufacturers Association supports the proposal. Several weights and measures jurisdictions indicated concern about how their weight carts will comply with requirements in the handbook, especially the fuel tank standards. The Work Group plans a more in depth review of fuel tank requirements. The Work Group indicated its plan to define a reasonable standard that allows existing weight carts to operate. Other

issues briefly discussed were the effects of weight cart uncertainties on the error limits for standards that are specified in Appendix A Fundamental Considerations Associated with the Enforcement of Handbook 44 Codes.

The Committee believes that weight cart standards developed for Handbook 44 and Handbook 105-8 should be consistent. Therefore, the Committee decided to move this developing item to an information item and awaits publication of the final Handbook 105-8.

322 Automatic Bulk Weighing Systems

322-1 I Tolerances

Source: Carryover Item 322-1. This item originated from the Northeastern Weights and Measures Association (NEWMA) and first appeared on the Committee's 2002 agenda.)

Recommendation: Delete paragraphs T.1.4., T.2., T.2.1, T.3.2. and T.3.3.; renumber paragraphs T.3. and T.3.1.; add new paragraphs T.2.2, T.2.3., and T.2.3.1. and Table 1 and Table 2; and add a new footnote to Section 2.20 Scales Table 1.1.1. as follows:

~~**T.1.4. To Tests Involving Digital Indications or Representations. - To the tolerances that would otherwise be applied, there shall be added an amount equal to one-half the value of the scale division. This does not apply to digital indications or recorded representations that have been corrected for rounding using error weights.**~~

~~**T.2. Minimum Tolerance Values. - The minimum tolerance value shall not be less than half the value of the scale division.**~~

~~**T.2.1. For Systems used to Weigh Construction Materials. - The minimum maintenance and acceptance tolerance shall be 0.1 percent of the weighing capacity of the system, or the value of the scale division, whichever is less .**~~

~~**T.3.2. For Systems used to Weigh Grain. - The basic maintenance tolerance shall be 0.1 percent of test load.**~~

~~**T.3.3. For all Other Systems. - The basic maintenance tolerance shall be 0.2 percent of test load.**~~

Renumber paragraphs T.3. and T.3.1. as follows:

T.~~3~~.2. Basic Tolerance Values.

T.~~3~~.2.1. Acceptance Tolerance. -The basic acceptance tolerance shall be one-half the basic maintenance tolerance but never less than 1 division.

Add new paragraphs T.2.2, T.2.3., and T.2.3.1. and Table 1 and Table 2 as follows:

T.2.2. General. - The tolerance applicable to devices not marked with an accuracy class shall have the tolerances applied as specified in Table 1. below.

Table 1. Tolerance for Unmarked Scales			
Type of Device	**Tolerance**	**Decreasing Load Multiplier**	**Other applicable Requirements**
Grain Hoppers	**Class III, T.2.3 (table 2)**	**1.0**	**T.2.1., T.2.3.1**
Other Systems	**Class III L, T.2.3 (table 2)**	**1.0**	**T.2.1., T.2.3.1**

T.2.3. Tolerances Applicable to Devices Marked III or III L.

T.2.3.1. Maintenance Tolerance Values - The maintenance tolerance values are specified in Table 2 below.

Table 2. Maintenance Tolerance for Marked Scales (All values in this table are in scale divisions) Tolerance in scale divisions				
	1	2	3	5
Class	Test Load			
III	0 - 500	501 - 2000	2001 - 4000	4001 +
III L	0 - 500	501 - 1000	(Add 1d for each additional 500 d or fraction thereof)	

Add a new footnote to Section 2.20 Scales Code Table 1.1.1. Tolerances for Unmarked Scales as follows:

[X]Automatic bulk weighing systems see Section 2.22 for specifications and tolerances.

Discussion: NEWMA recommended changing the prescribed tolerances for automatic bulk weighing systems from a percentage basis to division values which are based on the device's accuracy class. NEWMA believes this change will align tolerances in the Automatic Bulk Weighing Systems (ABWS) Code and Scales Code. Additionally, NEWMA believes a footnote should be added to the Scales Code Table T.1.1. to avoid any confusion about devices that can be classified as automatic bulk weighing systems.

The Committee recognized there is confusion over which weighing systems fall under the Automatic Bulk Weighing Systems Code. During the 2002 July NCWM Annual Meeting, the Committee encouraged the Technical Advisors to develop materials on automatic bulk weighing systems in time for presentations at the 2002 fall regional weights and measures association meetings. Consequently, the Committee kept this an information item.

The Western Weights and Measures Association agreed with the USDA Grain Inspection Packers and Stockyard Administration (GIPSA) concerns about the proposed tolerances permitting additional inaccuracies in automatic bulk weighing systems. Consequently, the WWMA recommends the NCWM S&T Committee withdraw this item from the agenda.

NEWMA reports that New York supports returning the item to voting status. New York believes the changes to the tolerances are necessary to align the code with other scale codes. New York provided GIPSA with charts and tables to demonstrate that the proposed tolerances, based on scale divisions, only minimally change the current tolerances. The charts were available at the 2003 NCWM Interim Meeting.

The Committee acknowledges there is still confusion about which code applies to hopper scales such as systems used in grain and asphalt applications. The Committee notes that adding a controller to a hopper or a hopper that makes a limited number of drafts (continuous) cannot be classified as an automatic bulk weighing system. Typically, an ABWS must record a load and no load for each successive draft.

The Committee made the proposal an information item to allow GIPSA and New York sufficient time to work through accuracy class and percentage based tolerance data. GIPSA indicated there is a problem with the proposal because it represents a tolerance based on accuracy class which results in a substantial cumulative error. New York stated the benefits to an accuracy class tolerance go beyond harmonizing the requirements in the ABWS and Scales Codes. One option discussed to resolve GIPSA's concerns about the impact of the proposed tolerances on weighing operations where GIPSA has oversight is to create an exemption for all grain scales similar to what exist in the Scales Code.

For more background information, refer to the 2002 S&T Final Report.

324 Automatic Weighing Systems

324-1 I Tentative Status of the Automatic Weighing Systems Code

Source: Carryover Item 324-1. (This item originated from the Southern Weights and Measures Association (SWMA) and first appeared on the Committee's 2002 agenda.)

Recommendation: Change the status of the Automatic Weighing Systems Code from tentative to permanent.

Discussion: The Automatic Weighing Systems Code was added to the 1996 edition of NIST Handbook 44 as a Tentative Code. In 2002, the adoption of the code as a permanent code in Handbook 44 was delayed to resolve issues with several NTEP test criteria which are based on code requirements. On October 2-3, 2002, in Annapolis, Maryland, a work group met to review any remaining code issues. The Work Group discussed Handbook 44 requirements that limit a device to operating in a single unit of measure. The Work Group questioned the need for NTEP laboratories to perform line frequency and barometric pressure test. The Work Group noted that there are inconsistencies in the titles of several requirements. Manufacturers indicated great concern because devices that meet Handbook 44 tolerances are producing packages that do not comply with NIST Handbook 130 requirements. The Work Group provided the Committee with proposals for changes to Handbook 44 at the 2003 NCWM Interim Meeting.

The Committee recognizes that the entire AWS Work Group has not had the opportunity to review and comment on a first draft of changes to the AWS Code. The Committee also heard that one member of the AWS Group plans to submit changes to the draft. Therefore, the Committee made the proposal an information item.

For more background information, refer to the 2002 S&T Final Report.

330 Liquid-Measuring Devices

330-1 I S.2.1. Multiple Measuring Elements With a Single Provision for Sealing

Source: National Type Evaluation Technical Committee Measuring Sector

Recommendation: Add new paragraph to NIST Handbook 44, Section 3.30. Liquid-Measuring Devices S.2.2.1. Multiple Measuring Elements with a Single Provision for Sealing as follows:

> **S.2.2.1. Multiple Measuring Elements with a Single Provision for Sealing. - A change to the adjustment of any measuring element within any multi-product dispenser with a single provision for sealing multiple measuring elements must be identified.**

Background/Discussion: At the June 2002 NTEP Laboratory Meeting, one of the participating laboratories indicated that field officials in their jurisdiction are having difficulty with multi-product dispensers that have only one sealing mechanism for two or more measuring elements. If a field official rejects a meter for not meeting performance requirements, they have no way of determining which measuring elements have been recalibrated when they return to reinspect the dispenser after a service agency has made adjustments or repairs on the rejected device. During the performance of a subsequent inspection following adjustment or repair of the device, the field official may be required to test all grades and blends offered through the rejected dispenser to determine that only the correct measuring element was adjusted.

At its October 2002 meeting, the NTETC Measuring Sector developed a proposal to address the concern with retail motor-fuel dispensers that have only one sealing mechanism that provides the adjustment security for multiple measuring elements. The Sector agreed to forward the proposal to the S&T Committee for consideration.

At its October 2002 Annual Meeting, the SWMA recommended that the proposal to add a new paragraph to NIST Handbook 44, Section 3.30. Liquid-Measuring Devices paragraph S.2.2.1. be forwarded to the NCWM S&T Committee as an information item.

At the 2003 NCWM Interim Meeting, the Committee heard support for identifying, in a manner that is readily available to the field official, any measuring element that is adjusted and agreed that the item has merit. Device manufactures present at the meeting stated that identifying any measuring element that is adjusted is possible on dispensers that have only one sealing mechanism for two or more measuring elements. The manufacturers requested time to develop an appropriate mechanism for providing that information. The Committee gave the item informational status to provide device manufacturers the opportunity to study the issue and develop means for meeting the proposed requirements.

330-2 V S.4.4.1. Discharge Rates

Source: National Type Evaluation Technical Committee Measuring Sector

Recommendation: Modify NIST Handbook 44, Section 3.30. Liquid-Measuring Devices (LMD) S.4.4.1. as follows:

> ***S.4.4.1. Discharge Rates. - On a retail device with a designed maximum discharge rate of 115 L (30 gal) per minute or greater, the maximum and minimum discharge rates shall be marked ~~on an exterior surface of the device and shall be visible after installation~~ in accordance with S.4.4.2. The minimum discharge rate shall not exceed 20 percent of the maximum discharge rate.***
>
> **Example: With a marked maximum discharge rate of 230 L/min (60 gpm), the marked minimum discharge rate shall be 45 L/min (12 gpm) or less (e.g., 40 L/min (10 gpm) is acceptable). A marked minimum discharge rate greater than 45 L/min (12 gpm) (e.g., 60 L/min (15 gpm)) is not acceptable.**

Background/Discussion: During its 2002 Annual Meeting, the NCWM voted to amend NIST Handbook 44 LMD Code paragraph S.4.4. Retail Devices by adding a new paragraph, S.4.4.2. *Location of Marking Information; Retail Motor-Fuel Dispenser* that requires that markings for G-S.1. Identification be located within a specified range of heights on a dispenser. The markings are also allowed to be located inside the dispenser. During the 2002 Measuring Sector meeting, it was noted the marking requirements for discharge rates are required to be located on an external surface of the device without any reference to being located within a specified height range. The Sector indicated that it is also appropriate to include the markings for discharge rates required in paragraph S.4.4.1. with the other markings in accordance with the requirements of paragraph S.4.4.2. Some weights and measures officials have incorrectly interpreted paragraph S.4.4.1. to mean that a flow rate greater than or less than 20 percent of the maximum discharge is not acceptable. The Sector agreed to forward to the S&T Committee through the SWMA a proposal to modify S.4.4.1. that includes an example of how the requirement should be applied.

At its October 2002 Annual Meeting the SWMA supported the proposed modification to S.4.4.1. and the accompanying example and recommended it be forwarded to the NCWM S&T Committee as a voting item.

At the 2003 NCWM Interim Meeting, the Committee heard no comments on this item. The Committee agreed that adding the example clarifies the intent of the paragraph and agreed to present it for a vote at the 2003 NCWM Annual Meeting.

330-3 V UR.1.2. Nozzle Requirements

Source: Carryover Item 330-4. (This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 2002 agenda.)

Recommendation: Add a new paragraph to NIST Handbook 44, Section 3.30. Liquid-Measuring Devices UR.1.2. as follows:

UR.1.2. Nozzle Requirements for Diesel. On a retail motor-fuel device any hose from which diesel fuel is sold shall have a nozzle with an outside diameter of not less than 23.6 mm (0.93 in).

Background/Discussion: At the August 2001 WWMA Technical Conference, Idaho Weights and Measures reported receiving complaints from consumers who accidentally put diesel fuel into a gasoline-powered vehicle. All complaints were investigated and inspectors found that the pumps were properly labeled, but people still accidentally selected the wrong product. The proposed user requirement would help prevent this unfortunate mix-up. Idaho Weights and Measures reported that retail motor-fuel dispenser manufacturers follow the minimum size specification in the Society of Automotive Engineers (SAE) Recommended Practice, J285, revised September 1992. SAE, J285 recommends that nozzle spouts for unleaded fuels have a nominal outside diameter of 20.6 mm (13/16 in) and that for all other fuels the nominal outside diameter should be 23.8 mm (15/16 in), but not less than 23.6 mm (0.93 in). The 1992 date for J285 indicates that automotive manufacturers have recommended for some time that fueling components meet this specification.

At the 2002 NCWM Annual Meeting, this item did not pass or fail; therefore, it was returned to the Committee for further consideration.

At its September 2002 Interim Meeting, the Central Weights and Measures Association recommended that this item be withdrawn from the S&T Committee Agenda and a similar item be added to the L&R Committee Agenda.

At its September 2002 Annual Meeting, the WWMA received documentation that the SAE Recommended Practice, J285, was reaffirmed in 1999. The WWMA recommends that the proposal be modified to include an effective date of January 1, 2005.

At its October 2002 Interim Meeting, the Northeastern Weights and Measures Association recommended that this item be withdrawn from the agenda.

At its October 2002 Annual Meeting, the Southern Weights and Measures Association was provided information on the cost of a nozzle spout for unleaded fuel and the recommended larger spout for diesel fuel to demonstrate that this proposal would cause no economic hardship for device owners and continues to support this item.

At the 2003 NCWM Interim Meeting, the Committee heard comments similar to those received at previous meetings. The Committee believed that the arguments for and against were about even. The Committee agreed to present the item for a vote at the 2003 NCWM Annual Meeting and let the Conference decide.

For more background information, refer to the NCWM 2002 S&T Final Report.

330-4 V UR.2.5. Product Identification

Source: National Type Evaluation Technical Committee Measuring Sector

Recommendation: Modify NIST Handbook 44, Section 3.30. Liquid-Measuring Devices UR.2.5. as follows:

UR.2.5. Product ~~Storage~~ Identification.

<u>UR.2.5.1. Measuring Element Identification.</u>

(a) <u>The measuring elements of any multi-product dispenser shall be permanently, plainly, and visibly identified as to product being measured.</u>

(b) <u>When the measuring elements of any multi-product dispenser is marked by means of a color code, the color code key shall be conspicuously displayed at the place of business.</u>

<u>(Added 200X)</u>

UR.2.5.2. Product Storage Identification.

(a) The fill connection for any petroleum product storage tank or vessel supplying motor-fuel devices shall be permanently, plainly, and visibly marked as to product contained.

(b) When the fill connection device is marked by means of a color code, the color code key shall be conspicuously displayed at the place of business.
(Added 1975 and Amended 1976 and renumbered 200X)

Background/Discussion: At the June 2002 NTEP Laboratory Meeting, one of the participating laboratories indicated that field officials in their jurisdiction are sometimes not able to determine which measuring element is associated with a particular grade or blend of fuel on multi-product dispensers. During a field examination of a multi-product dispenser if one grade or blend is rejected for not meeting performance requirements, the official does not know which measuring element to mark or tag as rejected. During the performance of a subsequent inspection following adjustment or repair of the device, the field official may be required to test all grades and blends offered through the rejected dispenser to determine that only the correct measuring element was adjusted.

At its October 2002 meeting, the NTETC Measuring Sector developed a proposal that requires a measuring element without an individual physical seal within any multi-product dispenser be plainly and visibly identified as to the product being measured. The Sector agreed to forward the proposal to the S&T Committee through the SWMA.

At its October 2002 Annual Meeting, the SWMA recommended that the proposed modification to NIST Handbook 44, Section 3.30. Liquid-Measuring Devices paragraph UR.2.5. be forwarded to the NCWM S&T Committee as a voting item.

At the 2003 NCWM Interim Meeting, the Committee heard support for identifying the product that any individual measuring element, of a dispenser with multiple measuring elements, is measuring. The device manufacturers present at the meeting agreed that this requirement would also assist service agencies making adjustments to a dispenser when the measuring element for only a certain product needs adjustment. The device manufacturers also agreed that, for devices currently in the market place, a user can readily identify the product that any individual measuring element, of a dispenser with multiple measuring elements, is measuring. The Committee believes it is important that a field official be able to identify what product is being measured by each measuring element and agreed to present the item for a vote at the 2003 NCWM Annual Meeting.

330-5 V UR.3.6.1.1. Temperature Compensation Wholesale – When to be Used

Source: Southern Weights and Measures Association (SWMA)

Recommendation: Revise NIST Handbook 44, Section 3.30. Liquid-Measuring Devices by adding a new paragraph UR.3.6.3. that requires the buyer and seller of products measured or calculated using temperature compensation to do so for a twelve-month period, unless mutually agreed in writing to do otherwise. The revision would be stated as follows:

UR.3.6.3. When fuel is bought or sold on an automatic or nonautomatic temperature-compensated basis, it shall be done over at least a consecutive 12-month period, unless otherwise agreed to by the buyer and the seller in writing.
(Added 200X)

Background/Discussion: At the October 2002 SWMA Annual Meeting, a weights and measures office expressed concern that temperature compensation is being selectively used during different times of the year. Depending on the temperature during the measurement, the buyer or the seller may have an advantage. If a company uses temperature compensation, it must be used for a consecutive 12-month period to prevent selective use of temperature compensation. The SWMA agreed that the issue has merit and recommended it be forwarded to the NCWM S&T Committee as an information item.

At the 2003 NCWM Interim Meeting, the Committee heard that the requirement should clearly state that it applies to sales that are compensated for the effect of temperature whether the compensation is done automatically by a device or manually using a calculator. The Committee also heard that any agreement between the buyer and seller to do otherwise should be in writing. The Committee agreed and developed the new paragraph UR.3.6.3. (proposed as a revision to paragraph UR.3.6.1.2. in the 2003 Interim agenda) shown above to be presented for a vote at the NCWM Annual Meeting.

330-6 I Appendix D; Definition of Retail Device

Source: Carryover Item 330-7 (This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 1999 agenda as Item 330-5.)

Recommendation: Modify the definition of retail devices as follows:

retail device. A device primarily used for non-resale use.

~~**single deliveries of less than 378 L (100 gal),**~~

~~**retail deliveries of motor fuels to individual highway vehicles, or**~~

~~**single deliveries of liquefied petroleum gas for domestic use and liquefied petroleum gas or liquefied anhydrous ammonia for nonresale use.**~~
[3.30, 3.31, 3.32, 3.37]

Background/Discussion: During the 2001 NCWM Annual Meeting, the Committee considered several proposals that define retail devices as those that deliver product to the final user. The Committee agreed that these proposals change the classification of some devices, previously classified as wholesale devices, to retail devices that are held to a lesser tolerance.

At the 2002 NCWM Interim Meeting, the Committee agreed that if Items 330-3A, 330-3B, and 331-3 were adopted, changes to the definition would be unnecessary and this item could be withdrawn from its agenda.

At the 2002 NCWM Annual Meeting, no comments were received on this item. Items 330-3A and 331-3 were adopted. Item 330-3B was carried over as informational to provide the regional associations the opportunity to identify and discuss any negative impact it would have on the affected codes in NIST Handbook 44.

At its September 2002 Interim Meeting, the Central Weights and Measures Association agreed that the word "primarily" is ambiguous and should be removed from the proposal.

At its September 2002 Annual Meeting, the Western Weights and Measures Association supported the item as proposed.

At its October 2002 Interim Meeting, the Northeastern Weights and Measures Association agreed that this item is unnecessary if accuracy classes are adopted for Section 3.32. through Section 3.36. and Section 3.38.

At the 2003 NCWM Interim Meeting, the Committee heard that even with the adoption of the accuracy class tables last year, a definition of "retail device" is still needed because the term retail is referenced in several paragraphs in the Liquid-Measuring Devices code and in other measuring device codes of NIST Handbook 44. The Committee believes that the term "primarily" in the retail device definition, is appropriate to provide weights and measures officials some flexibility for determining the applicability of various requirements on a case-by-case basis. The Committee agreed that the item should remain informational to allow further study of all the codes potentially affected by the change.

For more background information, refer to the 1999 through 2002 S&T Final Reports.

331 Vehicle-Tank Meters

331-1 V Recognition of Temperature Compensation

Source: Carryover Item 331-1 (This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 2000 agenda as Item 331-1.)

Recommendation: Modify NIST Handbook 44, Section 3.31. Vehicle-Tank Meters Code (VTM) by adding the following paragraphs to recognize temperature compensation as follows:

S.2.4. Automatic Temperature Compensation for Refined Petroleum Products.

S.2.4.1. Automatic Temperature Compensation for Refined Petroleum Products. - A device may be equipped with an automatic means for adjusting the indication and registration of the measured volume of product to the volume at 15 °C (60 °F), where not prohibited by State Law.

S.2.4.2. Provision for Deactivating. - On a device equipped with an automatic temperature-compensating mechanism that will indicate or record only in terms of liters (gallons) compensated to 15 °C (60 °F), provision shall be made for deactivating the automatic temperature-compensating mechanism so that the meter can indicate and record, if it is equipped to record, in terms of the uncompensated volume.

S.2.4.2.X. Gross and Net Indications – A device equipped with automatic temperature compensation shall indicate and record, if equipped to record, both the gross (uncompensated) and net (compensated) volume for testing purposes. If both values cannot be displayed or recorded for the same test draft, means shall be provided to select either the gross or net indication for each test draft.

S.2.4.3. Provision for Sealing Automatic Temperature Compensating Systems. – Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or physically applying security seals in such a manner that an automatic temperature-compensating system cannot be disconnected and that no adjustment may be made to the system.

S.2.4.4. Temperature Determination with Automatic Temperature Compensation. - For test purposes, means shall be provided (e.g., thermometer well) to determine the temperature of the liquid either:

(a) in the liquid chamber of the meter, or

(b) immediately adjacent to the meter in the meter inlet or discharge line.

S.5.6. Temperature Compensation for Refined Petroleum Products. - If a device is equipped with an automatic temperature compensator, the primary indicating elements, recording elements, and recording representation shall be clearly and conspicuously marked to show that the volume delivered has been adjusted to the volume at 15 °C (60 °F).

N.4.1.3. Automatic Temperature Compensating Systems for Refined Petroleum Products. - On devices equipped with automatic temperature-compensating systems, normal tests shall be conducted:

(a) by comparing the compensated volume indicated or recorded to the actual delivered volume corrected to 15 °C (60 °F); and

(b) with the temperature-compensating system deactivated, comparing the uncompensated volume indicated or recorded to the actual delivered volume.

The first test shall be performed with the automatic temperature-compensating system operating in the "as found" condition. On devices that indicate or record both the compensated and uncompensated volume for each delivery, the tests in (a) and (b) may be performed as a single test.

N.5. Temperature Correction for Refined Petroleum Products. - Corrections shall be made for any changes in volume resulting from the differences in liquid temperatures between the time of passage through the meter and time of volumetric determination in the prover. When adjustments are necessary, appropriate petroleum measurement tables should be used.

T.2.1. Automatic Temperature-Compensating Systems. - The difference between the meter error (expressed as a percentage) for results determined with and without the automatic temperature-compensating system activated shall not exceed:

(a) 0.4 percent for mechanical automatic temperature-compensating systems; and

(b) 0.2 percent for electronic automatic temperature-compensating systems.

The delivered quantities for each test shall be approximately the same size. The results of each test shall be within the applicable acceptance or maintenance tolerance.

UR.2.5. Temperature Compensation for Refined Petroleum Products.

UR.2.5.1. Automatic.

UR.2.5.1.1. When to be Used. – In a State that does not prohibit, by law or regulation, the sale of temperature-compensated product a device equipped with an operable automatic temperature compensator shall be connected, operable, and in use at all times. An electronic or mechanical automatic temperature compensating system may not be removed, nor may a compensated device be replaced with an uncompensated device, without the written approval of the responsible weights and measures jurisdiction.

[Note: This requirement does not specify the method of sale for product measured through a meter.]

UR.2.5.1.2. Invoices.

(a) An invoice based on a reading of a device that is equipped with an automatic temperature compensator shall show that the volume delivered has been adjusted to the volume at 15 °C (60 °F).

Discussion/Background: When this item was submitted, weights and measures officials indicated confusion about the specific meter applications that are covered by an NTEP Certificate of Conformance for a meter that includes the temperature-compensation feature. The WWMA acknowledged that there are jurisdictions that permit temperature compensated deliveries in applications that are not addressed by NIST Handbook 44. Other states do not allow the use of automatic temperature compensation for the delivery of products using a vehicle-tank meter.

At the 2002 NCWM Interim and Annual Meeting, the Committee also heard several comments supporting the item because the language does not require the use of temperature compensation, but does provide requirements and inspection aids for those jurisdictions that have temperature compensated vehicle-tank meters in use. The item provides specifications, tolerances, test notes, and user requirements if a temperature compensated device is used. The Committee did hear some opposition to the proposal from officials who believe they would be forced to accept temperature compensated vehicle-tank meters because there is not a specific prohibition in their weights and measures law; however,

the Committee concluded that the opposition was not supported by a technical argument and there are other means for prohibiting the use of temperature compensated vehicle-tank meters in a particular state. The Committee agreed to present the item for a vote at the 2002 NCWM Annual Meeting.

At the 2002 NCWM Annual Meeting, this item did not pass or fail; therefore, it was returned to the Committee for further consideration.

At its September 2002 Interim Meeting, the Central Weights and Measures Association reaffirmed its recommendation that the L&R Committee adopt appropriate language for a method of sale requirement for temperature compensated vehicle-tank meters to promote uniformity.

At its September 2002 Annual Meeting, the WWMA supported this item as proposed and recommends that the NCWM S&T Committee move it forward as a voting item.

At its October 2002 Interim Meeting, the Northeastern Weights and Measures Association recommended that the NCWM S&T Committee move this item forward as a voting item.

At the 2003 NCWM Interim Meeting, the Committee heard both support and opposition to this item for similar reasons expressed at earlier meetings. The Meter Manufactures Association (MMA) indicated that the proposed tolerances in T.2.1. of 0.2 percent for mechanical automatic temperature-compensating systems and 0.1 percent for electronic automatic temperature-compensating systems were too restrictive and should be changed to 0.4 percent for mechanical systems and 0.2 percent for electronic systems. The Committee agreed with the MMA and modified T.2.1. accordingly. The Committee agreed to present the item for a vote at the 2003 NCWM Annual Meeting as shown above.

For additional background on this item see the NCWM 2000 through 2002 S&T Final Reports.

331-2 W S.3.5. Discharge Valve

Source: Western Weights and Measures Association (WWMA)

Recommendation: Revise NIST Handbook 44, Section 3.31. Vehicle-Tank Meters by adding a sentence to S.3.5. as follows:

> **S.3.5 Discharge Valve- A discharge valve may be installed in the discharge line only if the device is of the wet-hose type *or is incorporated within an automatic pump discharge system*, in which case such valve shall be at the discharge end of the line. Any other shutoff valve on the discharge side of the meter shall be of the automatic or semiautomatic predetermined-stop type or shall be operable only:**
>
> **(a) by means of a tool (but not a pin) entirely separate from the device, or**
>
> **(b) by mutilation of a security seal with which the valve is sealed open.**

Discussion: Syltone Industries put forth this proposal as part of its endeavor to have dry-hose delivery systems recognized in NIST Handbook 44. The changes proposed to NIST Handbook 44 were believed necessary to allow the systems to begin the NTEP process. These systems would have had to be evaluated for accuracy, repeatability and other requirements. The systems are currently in use in Germany and the United Kingdom.

At its September 2002 Annual Meeting, the WWMA recommended this item move forward as an information item.

At its October 2002 Annual Meeting, the Southern Weights and Measures Association (SWMA) recommended that this item move forward as an information item. The SWMA has concerns with the repeatability and performance accuracy for the described system and does not support changing NIST Handbook 44 until the manufacturer provides performance data for consideration.

At the 2003 NCWM Interim Meeting the Committee agreed to withdrawn this item at the request of the original submitter, Syltone Industries, and with the support of the committee representatives from the WWMA and the SWMA.

331-3 W S.3.2.X. Automatic Pump Discharge Unit

Source: Western Weights and Measures Association (WWMA)

Recommendation: Revise NIST Handbook 44, Section 3.31. Vehicle-Tank Meters by adding a Specification S.3.2.X Automatic Pump Discharge Unit as follows:

> **S.3.2.X. Automatic Pump Discharge Unit. – On an automatic pump discharge unit, the discharge hose may be of the dry-hose type with a shutoff valve at its outlet end, but only if:**
>
> **(a) the pump discharge unit is completely automatic in that all openings and closing of valves incorporated within the system are controlled absolutely by the system, and**
>
> **(b) a means is provided to ensure that the pump discharge system will be dry at the beginning and the end of each delivery, and**
>
> **(c) a means is incorporated within the pump discharge system that detects if the hose end shutoff valve or any other valve downstream of the system is closed prematurely during the purging of the system to its dry state, thus preventing a complete delivery. In this case, means must be provided so that it will be impossible to end the delivery and print a delivery ticket. The system must provide the facility to automatically clear the discharge lines once the hose end shutoff valve has been opened or the obstruction preventing a complete delivery is removed, and**
>
> **(d) in the event that a delivery is terminated before the pre-set quantity is reached or the delivery quantity is unknown at the beginning of the delivery, then means must be provided to return the product contained within the pump discharge system back to the tank truck compartment and be fully discharged so as to bring the system back to its dry state. The system must ensure that product is returned to the tank truck and that this quantity does not form part of the delivered quantity.**
>
> **(e) There shall be incorporated an automatic vacuum breaker or equivalent means to prevent siphoning and to ensure the rapid and complete drainage of the automatic pump discharge unit.**

Discussion: Syltone Industries put forth this proposal as part of its endeavor to have dry hose delivery systems recognized in NIST Handbook 44. The changes proposed to Handbook 44 were believed necessary to allow the systems to begin the NTEP process. These systems would have had to be evaluated for accuracy, repeatability and other requirements. Syltone states that the systems are currently approved for use in Germany and the United Kingdom.

At its September 2002 Annual Meeting, the WWMA recommended this item move forward as an information item.

At its October 2002 Annual Meeting, the Southern Weights and Measures Association (SWMA) recommended that this item move forward as an information item. The SWMA has concerns with the repeatability and performance accuracy for the described system and does not support changing NIST Handbook 44 until the manufacture provides performance data for consideration.

At the 2003 NCWM Interim Meeting the Committee agreed to withdraw this item at the request of the original submitter, Syltone Industries, and with the support of the committee representatives from the WWMA and the SWMA.

331-4 W S.3.2.X. Flood Volume Automatic Pump Discharge Unit

Source: Western Weights and Measures Association (WWMA)

Recommendation: Revise NIST Handbook 44, Section 3.31. by adding a Specification S.3.2.X. Flood Volume Automatic Pump Discharge Unit as follows:

> **S.3.2.X. Flood Volume Automatic Pump Discharge Unit – When applicable, the volume of product necessary to flood the system when dry shall be clearly, conspicuously, and permanently marked on the system.**

Discussion: Syltone Industries put forth this proposal as part of its endeavor to have dry hose delivery systems recognized in NIST Handbook 44. The changes proposed to NIST Handbook 44 were believed necessary to allow the systems to begin the NTEP process. These systems would have had to be evaluated for accuracy, repeatability and other requirements. The systems are currently in use in Germany and the United Kingdom.

At its September 2002 Annual Meeting the WWMA recommended this item move forward as an information item.

At its October 2002 Annual Meeting the Southern Weights and Measures Association (SWMA) recommended that this item move forward as an information item. The SWMA has concerns with the repeatability and performance accuracy for the described system and does not support changing NIST Handbook 44 until the manufacturer provides performance data for consideration.

At the 2003 NCWM Interim Meeting the Committee agreed to withdraw this item at the request of the original submitter, Syltone Industries, and with the support of the committee representatives from the WWMA and the SWMA.

331-5 V UR.X. Test Liquid

Source: Southern Weights and Measures Association (SWMA)

Recommendation: Revise NIST Handbook 44, Section 3.31 Vehicle-Tank Meters by adding a user requirement as follows:

> **UR.1.4. Liquid Measured. – A Vehicle-Tank Meter shall continue to be used to measure the same liquid or one with the same general physical properties as that used for calibration and weights and measures approval unless the meter is recalibrated with a different product and tested by a registered service agency or a weights and measures official and approved by the weights and measures jurisdiction having statutory authority over the device.**

Discussion: At the October 2002 SWMA Annual Meeting, a weights and measures office stated that paragraph N.1. Test Liquid in the Vehicle-Tank Meters Code requires that a meter test be conducted with the same liquid or one with the same general physical characteristics as the one being commercially measured. However there is no user requirement that requires the user to continue to use the product with which the meter was tested. The SWMA agreed that the issue has merit and recommended it be forwarded to the NCWM S&T Committee as an information item.

At the 2003 NCWM Interim Meeting, the Committee received comments that the proposal should be modified to include testing and approval by weights and measures officials. The Committee agreed with the comments, modified the proposal and decided to present it for a vote at the 2003 NCWM Annual Meeting as shown above.

331-6 I N.4.2. Special Tests (Except Milk-Measuring Systems), N.4.5. Product Depletion Test, and T.5. Product Depletion Test

Source: Northeastern Weights and Measures Association (NEWMA)

Recommendation: Modify NIST Handbook 44, Section 3.32. Vehicle-Tank Meters paragraph N.4.2. Special Tests (Except Milk-Measuring Systems) as follows:

> **N.4.2. Special Tests (Except Milk-Measuring Systems). "Special" tests shall be made to develop the operating characteristics of a measuring system and any special elements and**

accessories attached to or associated with the device. Any test except as set forth in N.4.1. or N.4.5. shall be considered a special test. Special test of a measuring system shall be made as follows:

(a) at a minimum discharge rate of 20 percent of the marked maximum discharge rate or at the minimum discharge rate marked on the device whichever is less;

(b) to develop operating characteristics of the measuring system ~~during a split-compartment delivery~~.

Add new paragraphs N.4.5. Product Depletion Test and T.5. Product Depletion Test to the Vehicle-Tank Meters Code as follows:

N.4.5. Product Depletion Test. – The effectiveness of the vapor eliminator shall be tested by depleting the product supply and continuing until the lack of fluid causes the meter register to stop completely. The test shall be completed by switching to another compartment with sufficient product on a multi-compartment vehicle, or by adding sufficient product to a single compartment vehicle. When adding product to a single compartment vehicle, allow appropriate time for any entrapped vapor to disperse before continuing the test.

T.5. Product Depletion Test. – The difference in the delivered volumes for the normal test and the product depletion test shall not exceed 0.5 percent of the equivalent of one minute of flow at the maximum rated flow rate for the system.

Discussion: The proposal intends to recognize that the vapor measured when product is depleted during the vehicle-tank meter split compartment test (product depletion test) is a system problem that is not related to the prover size. The proposal requires a split compartment test (product depletion test) for single compartment vehicles to verify the performance of the air elimination mechanism.

At the 2003 NCWM Interim Meeting, the Committee agreed the proposal has merit because the product depletion test is necessary for vehicle-tank meters and the proposal provides guidelines on the appropriate test conditions. Therefore, the Committee changed the status of this item from developing to an information item. The proposal is based on the flow rate rather than the size of the prover and the tolerance stays the same regardless of the size of the prover. NEWMA noted concerns because operator with vehicle-tank meters that fail tests completed with 100-gallon provers are passing tests in neighboring jurisdictions that use larger prover standards (i.e., 200-gallon).

The Committee is uncertain that all sizes of vehicle-tank meters can attain the 0.5 percent tolerance proposed for the difference in the test results between the normal and product depletion tests. The Committee asks for data that demonstrates the ability of vehicle-tank meters to meet the proposed tolerance. The Committee also recommends NEWMA consult with Measurement Canada on its test procedures and develop guidelines for switching tanks when all tanks are not the same size to ensure an adequate test of the vehicle-tank meters since tanks of different sizes drain at different rates.

To provide input on this proposal contact Ross Andersen (New York Bureau of Weights and Measures) by telephone at 518-457-3146, by fax at 518-457-5693, or by email at ross.andersen@agmkt.state.ny.us or Stephen Martin (New York Bureau of Weights and Measures) by telephone at 315-487-2250, by fax at 315-487-2408, or by email at weighsyr@agmkt.state.ny.us.

332 LPG and Anhydrous Ammonia Liquid-Measuring Devices

332-1 V Tolerances, Table T.2. Accuracy Classes for Section 3.32. LPG and Anhydrous Ammonia Liquid-Measuring Devices

Source: Carryover Item 330-3B. (This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 1999 agenda as Item 330-1.)

Recommendation: Carryover Item 330-3B. (This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 1999 agenda as Item 330-1.)

Recommendation: Add a new Table T.2. to NIST Handbook 44, Section 3.32 LPG and Anhydrous Liquid-Measuring Devices and modify Paragraph T.2. as follows:

T.2. Tolerance Values. – The maintenance and acceptance tolerances for normal and special tests shall be <u>as shown in Table T.2.</u>

	~~Acceptance Tolerance~~	~~Maintenance Tolerance~~
~~Normal Tests~~	~~0.6%~~	~~1.0%~~
~~Special Tests~~	~~1.0%~~	~~1.0%~~

Table T.2. Accuracy Classes and Tolerances for LPG and Anhydrous Ammonia Liquid-Measuring Devices

<u>Accuracy Class</u>	<u>Application</u>	<u>Acceptance Tolerance</u>	<u>Maintenance Tolerance</u>	<u>Special Test Tolerance*</u>
<u>1.0</u>	<u>Anhydrous ammonia, LP gas (including vehicle tank meters)</u>	<u>0.6 %</u>	<u>1.0 %</u>	<u>1.0 %</u>
***where applicable**				

Background/Discussion: At the 2002 NCWM Interim Meeting, the Committee made Item 330-3B informational to allow further study on the effect of the proposed tolerances for devices covered by Section 3.32. through Section 3.38.

At the 2002 NCWM Annual Meeting, the Committee received no negative comments on this item.

Item 330-1B was divided into a separate item for each affected NIST Handbook 44 code. The tolerances shown in the proposed table are the same as the current NIST Handbook 44 tolerances. The proposed table format will facilitate the reformatting of all NIST Handbook 44 Section 3 liquid-measuring device codes.

At its September 2002 Annual Meeting, the WWMA recognized that this format will facilitate the reformatting of NIST Handbook 44 and recommends that the NCWM S&T Committee move it forward as a voting item.

At its October 2002 Interim Meeting, the Northeastern Weights and Measures Association recommended that the NCWM S&T Committee move this item forward as a voting item.

At the 2003 NCWM Interim Meeting, the Committee heard no comments on the item and agreed to present it for a vote at the 2003 NCWM Annual Meeting.

For additional background on this Item see item 330-3B in the NCWM 2002 S&T Final Report.

332-2 I UR.2.3. Vapor-Return Line

Source: Carryover Item 332-2. (This item was developed by the Southern Weights and Measures Association (SWMA) and first appeared on the Committee's 2002 agenda.)

Recommendation: Modify NIST Handbook 44, Section 3.32. LPG and Anhydrous Ammonia Liquid-Measuring Devices paragraph UR.2.3. as follows:

> UR.2.3. Vapor Return Line – During any metered delivery of liquefied petroleum gas from a supplier's tank to a receiving container, there shall be no vapor-return line from the receiving container to the supplier tank **except**:
>
> (a) in the case of any receiving container to which normal deliveries can**not** be made without the use of such vapor-return line, or
>
> (b) in the case of any new receiving container when the ambient temperature is ~~below~~ **above** 90 °F, or **in the case of wholesale terminal deliveries.**

Background/Discussion: At its September 2001 Annual Meeting, the SWMA heard a concern from Tennessee that vapor-return lines are commonly used at LPG loading rack terminals where large capacity transports are loaded for distribution to bulk LPG dealers. At least some of the companies operating terminals are applying industry derived factors that are used to credit customers for metered product that is returned as vapor to the sellers' storage tanks. Paragraph U.R.2.3. (a) provides an exception for abnormal conditions, such as high pressure in the receiving tank, which prevents delivery without the use of a vapor return line. The SWMA questions whether or not bulk terminal locations fall under this exemption. The terminals where vapor-return lines are being used have insufficient pumping ability to fill the large vessels that are used to distribute LPG to bulk dealer facilities; however, when pumping capacity becomes an issue the condition can be remedied by installing new pumping and metering equipment which is capable of filling the large pressure vessels without a vapor-return line. Additionally, the terminals have the option of weighing the product rather than metering it. These conditions exist at LPG terminals in all regions of the United States, thus, this is not a unique situation only affecting the State of Tennessee.

SWMA agreed with Tennessee that the following points should be reviewed to remove any ambiguity about the appropriateness of vapor return lines in various LPG filling operations:

1. Allow loading rack terminals to use vapor-return lines and review a proposal from industry on applying the vapor factor to credit the purchaser. A mean credit value may be adequate, although it has been determined that the vapor returned is not always consistent from delivery to delivery.
2. Allow a vapor meter to be installed between the receiving vessel and the seller's tanks, then convert the vapor measurements to liquid quantities and credit the purchaser.
3. Provide a consensus opinion that bulk terminal loading-rack installations meet the exception contained in paragraph UR.2.3. (a) and no action is needed by weights and measures officials.
4. Provide a consensus opinion that the conditions do not meet the exception noted in paragraph UR.2.3. and weights and measures official should require terminals currently unable to load without vapor-return lines to take corrective action to comply with NIST Handbook 44.

The SWMA recognized the concerns of the State of Tennessee and agreed to forward this item to NCWM, but recommends it remain informational to allow time for the submitter to develop specific language.

At the 2002 NCWM Interim and Annual Meetings, the Committee recognized the concerns of the SWMA and gave the item informational status to allow the submitter time to develop a specific proposal.

At its 2002 Annual Meeting, the WWMA recommended that this item remain as an information item until a specific proposal is submitted.

Following the 2003 NCWM Interim Meeting, the Committee received the proposal shown in the recommendation above from the State of Tennessee. The Committee agreed the item should remain informational to provide the regional associations an opportunity to review and discuss Tennessee's proposal.

333 Hydrocarbon Gas Vapor-Measuring Devices

333-1 V Tolerances, Table T.1. Accuracy Classes for Section 3.33. Hydrocarbon Gas Vapor-Measuring Devices

Source: Carryover Item 330-3B. (This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 1999 agenda as Item 330-1.)

Recommendation: Add a new Table T.1. to NIST Handbook 44, Section 3.33 Hydrocarbon Gas Vapor-Measuring Devices and modify Paragraph T.1. as follows:

> **T.1. Tolerance Values on Normal Tests and on Special Tests Other Than Low-Flame Tests. - Maintenance and acceptance tolerances for normal and special tests for hydrocarbon gas vapor-measuring devices shall be as shown in Table T.1. ~~3 percent (1.03 proof) of the test draft on underregistration and 1.5 percent (0.985 proof) of the test draft on overregistration.~~**
> (Amended 1981and 200X)

Table T.1. Accuracy Classes and Tolerances or Hydrocarbon Gas Vapor-Measuring Devices				
Accuracy Class	**Application**		**Acceptance Tolerance**	**Maintenance Tolerance**
3.0	**Gases at low pressure (LP vapor)**	**Overregistration**	**1.5 %**	**1.5 %**
		Underregistration	**3.0 %**	**3.0 %**

Background/Discussion: At the 2002 NCWM Interim Meeting, the Committee made Item 330-1B informational to allow further study on the effect of the proposed tolerances for devices covered by Section 3.32. through Section 3.38.

At the 2002 NCWM Annual Meeting, the Committee received no negative comments on this item.

Item 330-3B was divided into a separate item for each affected NIST Handbook 44 code. The tolerances shown in the proposed table are the same as the current NIST Handbook 44 tolerances. The proposed table format will facilitate the reformatting of all NIST Handbook 44 Section 3 liquid-measuring device codes.

At is September 2002 Annual Meeting the WWMA recognized that this format will facilitate the reformatting of NIST Handbook 44 and recommends that the NCWM S&T Committee move it forward as a voting item.

At its October 2002 Interim Meeting the NEWMA recommended that the NCWM S&T Committee move this item forward as a voting item.

At the 2003 NCWM Interim Meeting, the Committee heard no comments on this item and agreed to present it for a vote at the 2003 NCWM Annual Meeting.

For additional background on this item see Item 330-3B in the NCWM 2002 S&T Final Report.

334 Cryogenic Liquid-Measuring Devices

334-1 V Tolerances, Table T.2. Accuracy Classes for Section 3.34. Cryogenic Liquid-Measuring Devices

Source: Carryover Item 330-3B. (This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 1999 agenda as Item 330-1.)

Recommendation: Add a new Table T.2. to NIST Handbook 44, Section 3.34 Cryogenic Liquid-Measuring Devices delete paragraphs T.2.1. and T.2.2. and modify Paragraph T.2. as follows:

T.2. Tolerance Values. - The maintenance and acceptance tolerances for normal and special tests shall be as shown in Table T.2.

~~**T.2.1. On Normal Tests. - The maintenance tolerance on "normal" tests shall be two and one-half percent (2.5 %) of the indicated quantity. The acceptance tolerance shall be one and one-half percent (1.5 %) of the indicated quantity.**~~

~~T.2.2. On Special Tests. - The maintenance and acceptance tolerance on "special" tests shall be two and one-half percent (2.5 %) of the indicated quantity.~~

Table T.2. Accuracy Classes and Tolerances for Cryogenic Liquid-Measuring Devices

Accuracy Class	Application	Acceptance Tolerance	Maintenance Tolerance	Special Test Tolerance*
2.5	Cryogenic products; liquefied compressed gases other than LP gas	1.5 %	2.5 %	2.5 %

***where applicable**

Background/Discussion: At the 2002 NCWM Interim Meeting, the Committee made item 330-1B informational to allow further study on the effect of the proposed tolerances for devices covered by Section 3.32. through Section 3.38.

At the 2002 NCWM Annual Meeting, the Committee received no negative comments on this item.

Item 330-3B was divided into a separate item for each affected NIST Handbook 44 code. The tolerances shown in the proposed table are the same as the current NIST Handbook 44 tolerances. The proposed table format will facilitate the reformatting of all NIST Handbook 44 Section 3 liquid-measuring device codes.

At is September 2002 Annual Meeting, the WWMA recognized that this format will facilitate the reformatting of NIST Handbook 44 and recommended that the NCWM S&T Committee move it forward as a voting item.

At its October 2002 Interim Meeting, the Northeastern Weights and Measures Association recommended that the NCWM S&T Committee move this item forward as a voting item.

At the 2003 NCWM Interim Meeting, the Committee heard no comments on this item and agreed to present it for a vote at the 2003 NCWM Annual Meeting.

For additional background on this item see item 330-3B in the NCWM 2002 S&T Final Report.

334-2 V Definition for Cryogenic Liquid-Measuring Devices

Source: National Type Evaluation Technical Committee Measuring Sector

Recommendation: Modify the NIST Handbook 44 definition for cryogenic liquid-measuring device as follows.

> **cryogenic liquid-measuring device. A system including a liquid-measuring element ~~mechanism or machine of (a) the meter of the positive displacement, turbine, or mass flow type, or (b) a weighing type of device mounted on a vehicle,~~ designed to measure and deliver cryogenic liquids in the liquid state. Means may be provided to indicate automatically, for one of a series of unit prices, the total money value of the liquid measured.[3.34]**
> **(Amended 1986, 200X)**

Background/Discussion: In 1986 paragraph A.1. of Section 3.34. Cryogenic Liquid-Measuring Devices and the definition for cryogenic liquid-measuring devices were modified to include on-board-weighing systems for measuring cryogenic liquid. In 1995 the reference to scales for measuring cryogenic liquids was removed from paragraph A.1., because vehicle on-board weighing systems were recognized in the Scales Code in 1992. The NTETC Measuring Sector recognized that the reference to scales for measuring cryogenic liquids was not removed from the definition for cryogenic liquid-measuring device in 1995 and recommended that the definition be modified to reflect the 1995 change to paragraph A.1.

At its October 2002 Meeting the NTETC Measuring Sector reviewed the proposal and agreed to forward it to the NCWM S&T Committee for consideration.

At its October 2002 Annual Meeting, the Southern Weights and Measures Association supported the proposal and recommended that the NCWM S&T Committee move it forward as a voting item.

At the 2003 NCWM Interim Meeting, the Committee heard no comments on this item and agreed to present it for a vote at the 2003 NCWM Annual Meeting.

335 Milk Meters

335-1 W Tolerances, Table T.X. Accuracy Classes for Section 3.35. Milk Meters

Source: Carryover Item 330-3B. (This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 1999 agenda as Item 330-1.)

Recommendation: Add the following new Table T.X. for Liquid-Measuring Devices to NIST Handbook 44, Sections 3.32. LPG and Anhydrous Ammonia Liquid-Measuring Devices, 3.33. Hydrocarbon Gas Vapor-Measuring Devices, 3.34. Cryogenic Liquid-Measuring Devices, 3.35. Milk Meters, 3.36. Water Meters, 3.37. Mass Flow Meters, and 3.38. Carbon Dioxide Liquid-Measuring Devices. As an option the entire table could be added as an appendix to these codes.

Table T.X Accuracy Classes for Liquid Measuring Devices Covered in NIST Handbook 44 Sections 3.32 through 3.38					
Accuracy Class	**Application**		**Acceptance Tolerance**	**Maintenance Tolerance**	**Special Test Tolerance***
1.0	**Anhydrous ammonia, LP gas (including vehicle tank meters)**		**0.6 %**	**1.0 %**	**1.0 %**
1.5	**Water**	**Overregistration**	**1.5 %**	**1.5 %**	**1.5 %**
		Underregistration	**1.5 %**	**1.5 %**	**5.0 %**
2.0	**Compressed natural gas as a motor fuel**		**1.5 %**	**2.0 %**	**2.0 %**
2.5	**Cryogenic products; liquefied compressed gases other than LP gas**		**1.5 %**	**2.5 %**	**2.5 %**
3.0	**Gases at low pressure (LP vapor)**	**Overregistration**	**1.5 %**	**1.5 %**	
		Underregistration	**3.0 %**	**3.0 %**	
***where applicable**					

Background/Discussion: At the 2002 NCWM Annual Meeting, the Committee received no negative comments on item 330-1B. The Committee made item 330-1B informational to allow further study on the effect of the proposed tolerances for devices covered by Section 3.32. through Section 3.38.

Item 330-3B was divided into a separate item for each affected NIST Handbook 44 code. The tolerances shown in the proposed table are the same as the current NIST Handbook 44 tolerances. The proposed table format will facilitate the reformatting of all NIST Handbook 44 liquid-measuring device codes.

[**Technical Advisors' Note:** The proposed table above does not include a specific class designation and tolerances for devices measuring milk as it does for devices measuring other commodities. When Table T.1. for Section 3.31. Vehicle-Tank Meters was adopted at the 2002 NCWM Annual Meeting, Table 2. Tolerances for Vehicle-Mounted Milk Meters was not deleted from the code. The existing Table 1.Tolerances for Milk Meters and Table 2. Tolerances for Vehicle-Mounted Milk Meters provide the same tolerances for both applications. If Table 2. Tolerances for Milk Meters is to be replaced with a table providing an accuracy class and tolerances for milk meters then a class designation and an appropriate percent tolerance need to be developed.]

At its September 2002 Annual Meeting, the WWMA agreed that the above table does not include tolerances for milk meters. No specific proposal recommending a single percentage tolerance for milk meters was available for review. The WWMA recommends that this item remain an information item until a specific proposal is submitted for consideration.

At the 2003 NCWM Interim Meeting, the Committee agreed that the current Table 1. Tolerances for Milk Meters in the milk meters code should be retained to be consistent with the milk meter tolerances in the vehicle-tank meters code. The Committee agreed to withdraw this item from its agenda.

For additional background on this item see item 330-3B in the NCWM 2002 S&T Final Report.

336 Water Meters

336-1 V Tolerances, Tables N.1., N.2., T.1. Accuracy Classes for Section 3.36. Water Meters

Source: Carryover Item 330-3B. (This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 1999 agenda as Item 330-1.)

Recommendation: Modify NIST Handbook 44, Section 3.36 Water Meters paragraphs N.3., N.4.1., and N.4.2.., delete existing Table 1 and Table 2., add new Tables N.1., N.2. and T.1. as shown below.

N.3. Test Drafts. - Test drafts should be equal to at least the amount delivered by the device in 2 minutes and in no case less than the amount delivered by the device in 1 minute at the actual maximum flow rate developed by the installation. The test drafts shown in Table N.1., next page, shall be followed as closely as possible.

N.4. Testing Procedures.

N.4.1. Normal Tests. The normal test of a meter shall be made at the maximum discharge rate developed by the installation. Meters with maximum gallon per minute ratings higher than Table N.1. values may be tested up to the meter rating, with meter indications no less than those shown.
(Amended 1990 and 2002)

N.4.1.1. Repeatability Tests. – Tests for repeatability should include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors, such as temperature, pressure, and flow rate are reduced to the extent that they will not affect the results obtained.
(Added 2002)

N.4.2. Special Tests. - Special tests to develop the operating characteristics of meters may be made according to the rates and quantities shown in Table N.2.

Table N.1. Flow Rate and Draft Size for Water Meters
Normal Tests

Meter size (inches)	Rate of flow (gal/min)	Maximum Rate	
		Meter Indication/Test Draft	
		Gal	ft^3
Less than 5/8	8	50	5
5/8	15	50	5
3/4	25	50	5
1	40	100	10
1 1/2	80	300	40
2	120	500	40
3	250	500	50
4	350	1 000	100
6	700	1 000	100

Table N.2. Flow Rate and Draft Size for Water Meters Special Tests						
Meter size (inches)	Intermediate Rate			Minimum Rate		
	Rate of flow (gal/min)	Meter indication/Test Draft		Rate of flow (gal/min)	Meter indication/Test Draft	
		gal	ft^3		gal	ft^3
Less than or equal to 5/8	2	10	1	1/4	5	1
3/4	3	10	1	1/2	5	1
1	4	10	1	3/4	5	1
1 1/2	8	50	5	1 1/2	10	1
2	15	50	5	2	10	1
3	20	50	5	4	10	1
4	40	100	10	7	50	5
6	60	100	10	12	50	5

Table T.1. Accuracy Classes and Tolerances for Water Meters					
Accuracy Class	Application		Acceptance Tolerance	Maintenance Tolerance	Special Test Tolerance*
1.5	Water	Overregistration	1.5 %	1.5 %	1.5 %
		Underregistration	1.5 %	1.5 %	5.0 %
*where applicable					

Background/Discussion: At the 2002 NCWM Interim Meeting, the Committee made item 330-1B informational to allow further study on the effect of the proposed tolerances for devices covered by Section 3.32. through Section 3.38.

At the 2002 NCWM Annual Meeting, the Committee received no negative comments on this item.

Item 330-3B was divided into a separate item for each affected NIST Handbook 44 code. The tolerances shown in the proposed Table T.X. are the same as the current NIST Handbook 44 tolerances. The proposed table format will facilitate the reformatting of all NIST Handbook 44 Section 3 liquid-measuring device codes.

At its September 2002 Annual Meeting, the WWMA supported the concept of having accuracy classes and tolerances in a uniform table format for all liquid-measuring device codes; however, the existing Table 1 and Table 2 in the Water Meters Code include criteria for test draft sizes and for maximum, intermediate, and minimum flow rates for testing various sizes of water meters. The test draft size and flow rate information in Table 1 and Table 2 needs to be retained. The WWMA recommended that this item remain informational until a proposal to retain the flow rate criteria to accompany the new table for accuracy class and tolerances is developed.

At the 2003 NCWM Interim Meeting, the Committee and the technical advisors developed new test notes and tables to replace the current Table 1 and Table 2 to retain test recommendations for flow rate and draft size. The Committee agreed to present the item for a vote at the 2003 NCWM Annual Meeting.

For additional background on this item see Item 330-3B in the NCWM 2002 S&T Final Report.

336-2 V N.4.2. Special Tests, Table 2. Tolerances for Water Meters Special Tests

Source: Western Weights and Measure Association (WWMA)

Recommendation: Add a new paragraph S.2.3 to NIST Handbook 44, Section 3.36 Water Meters, and modified Table T.1. (as proposed in item 336-1) as follows:

> **S.2.3. Multi-Jet Meter Identification. – Multi-Jet water meters shall be identified as such on the Certificate of Conformance.**

Table T.1. Accuracy Classes and Tolerances for Water Meters					
Accuracy Class	**Application**		**Acceptance Tolerance**	**Maintenance Tolerance**	**Special Test Tolerance***
1.5	**Water *other than Multi-Jet***	**Overregistration**	**1.5 %**	**1.5 %**	**1.5 %**
		Underregistration	**1.5 %**	**1.5 %**	**5.0 %**
1.5	**Water Multi-jet**	**Overregistration**	**1.5 %**	**1.5 %**	**3.0 %**
		Underregistration	**1.5 %**	**1.5 %**	**3.0 %**
***where applicable**					

Add a new definition to Appendix D:

> **Multi-Jet Water Meter. A water meter in which the moving element takes the form of a multiblade rotor mounted on a vertical spindle within a cylindrical measuring chamber. The liquid enters the measuring chamber through several tangential orifices around the circumference and leaves the measuring chamber through another set of tangential orifices placed at a different level in the measuring chamber. These meters register by recording the revolutions of a rotor set in motion by the force of flowing water striking the blades. [3.36]**

Discussion: Currently the water meters code does not include any test criteria or tolerances for multi-jet water meters. Multi-jet meters are widely used for metering and sub-metering water. One manufacturer of these meters indicates that the performance curve for a multi-jet meter is different than the performance curve for a positive displacement meter and believes that the tolerances for underregistration and overregistration for a multi-jet meter should be equal. The American Water Works Association (AWWA) has recognized these differences and has set up two standards C700 and C708 to allow for the different meter accuracy curves.

At its September 2002 Annual Meeting, the WWMA agreed that test criteria and tolerances for multi-jet water meters should be included in the water meters code and agreed to forward it to the NCWM S&T Committee as an information item.

At the 2003 NCWM Interim Meeting, the Committee and the technical advisors developed a new tolerance table T.1. based on the table proposed in item 336-1 that includes tolerances for multi-jet water meters to replace the ones proposed by WWMA which do not follow the new format proposed for all liquid-measuring device codes. The Committee agreed to present the item for a vote at the 2003 NCWM Annual Meeting.

338 Carbon Dioxide Liquid-Measuring Devices

338-1 V Tolerances, Table T.1. Accuracy Classes for Section 3.38. Carbon Dioxide Liquid-Measuring Devices

Source: Carryover Item 330-3B. (This item originated from the Western Weights and Measures Association (WWMA) and first appeared on the Committee's 1999 agenda as Item 330-1.)

Recommendation: Add a new Table T.2. to NIST Handbook 44, Section 3.38 Carbon Dioxide Liquid-Measuring Devices modify Paragraph T.2. and delete paragraphs T.2.1. and T.2.2. as follows:

T.2. Tolerance Values. - The maintenance and acceptance tolerances for normal and special tests shall be as shown in Table T.2.

~~**T.2.1. On Normal Tests.** The maintenance tolerance on "normal" tests shall be two and one half percent (2.5 %) of the indicated quantity. The acceptance tolerances shall be one and one half percent (1.5 %) of the indicated quantity.~~

~~**T.2.2. On Special Tests.** The maintenance and acceptance tolerance on "special" tests shall be two and one half percent (2.5 %) of the indicated quantity.~~

Table T.2. Accuracy Classes and Tolerances for Carbon Dioxide Liquid-Measuring Devices

Accuracy Class	Application	Acceptance Tolerance	Maintenance Tolerance	Special Test Tolerance*
2.5	Cryogenic products; liquefied compressed gases other than LP gas	1.5 %	2.5 %	2.5 %
*where applicable				

Background/Discussion: At the 2002 NCWM Interim Meeting, the Committee agreed with the WWMA recommendation to split item 330-1 into items 330-3A and 330-3B. The Committee also made item 330-3B informational to allow further study on the effect of the proposed tolerances for devices covered by Section 3.32.through Section 3.38. The background and rational for this item are outlined in the 2002 NCWM S&T Agenda Item 330-3A and 331-1 that address the proposed changes to Sections 3.30 and 3.31.

At the 2002 NCWM Annual Meeting, the Committee received no negative comments on this item.

At the 2003 NCWM Interim Meeting, the Committee heard no comments on this item and agreed to present it for a vote at the 2003 NCWM Annual Meeting.

356(a) Grain Moisture Meters

356(a)-1 V Recognize Indications and Recorded Representations of Test Weight per Bushel

Source: This item originated from the National Type Evaluation Technical Committee (NTETC) Grain Moisture Meter (GMM) Sector and first appeared on the S&T Committee's 2000 agenda as Developing Item 360-3, Appendix D. The submitter of the item, the GMM Sector, believes the proposal is ready for national review.

Recommendation: Modify 5.56(a) Grain Moisture Meter Code Section in NIST Handbook 44 to recognize indications and recorded representation of test weight per bushel as follows:

Amend the following paragraphs:

A.1. – This code applies to grain moisture meters; that is, devices used to indicate directly the moisture content of cereal grain and oil seeds. The code consists of general requirements applicable to all moisture meters and specific requirements applicable only to certain types of moisture meters. Requirements cited for "test weight per bushel" indications or recorded representations are applicable only to devices incorporating an automatic test weight per bushel measuring feature.

S.1.1. Digital Indications and Recording Elements.

(c) Meters shall be equipped with a communication interface that permits interfacing with a recording element and transmitting the date, grain type, grain moisture results, test weight per bushel results and calibration version identification.

(d) A digital indicating element shall not display and a recording element shall not record any moisture content values or test weight per bushel values before the end of the measurement cycle.

(e) Moisture content results shall be displayed and recorded as percent moisture content, wet basis. Test weight per bushel results shall be displayed and recorded as pounds per bushel. Subdivisions of ~~this~~ these units shall be in terms of decimal subdivisions (not fractions).

(f) A meter shall not display or record any moisture content or test weight per bushel values when the moisture content of the grain sample is beyond the operating range of the device, unless the moisture and test weight representations includes a clear error indication (and recorded error message with the recorded representations).

S.1.3. Operating range. – A meter shall automatically and clearly indicate when the operating range of the meter has been exceeded. The operating range shall specify the following:

(c) Moisture Range of the Grain or Seed. The moisture range for each grain or seed for which the meter is to be used shall be specified. ~~A moisture~~ Moisture and test weight per bushel values may be displayed when the moisture range is exceeded if accompanied by a clear indication that the moisture range has been exceeded.

S.1.4. Value of Smallest Unit. – The display shall permit ~~constituent~~ moisture value determination to both 0.01 percent and 0.1 percent solution. The 0.1 percent resolution is for commercial transactions; the 0.01 percent resolution is for type evaluation and calibration purposes only, not for commercial purposes. Test weight per bushel values shall be determined to the nearest 0.1 pound per bushel.

S.2.4.1. Calibration Version. – A meter must be capable of displaying either calibration constants, a unique calibration name, or a unique calibration version number for use in verifying that the latest version of the calibration is being used to make moisture content and test weight per bushel determinations.

S.2.6. Determination of Quantity and Temperature. – The moisture meter system shall not require the operator to judge the precise volume or weight and temperature needed to make an accurate moisture determination. External grinding, weighing, and temperature measurement operations are not permitted. In addition, if the meter is capable of measuring test weight per bushel, determination of sample volume and weight for this measurement shall be fully automatic *and means shall be provided to ensure that measurements of test weight*

per bushel are not allowed to be displayed or printed when an insufficient sample volume is available to provide an accurate measurement.
[Nonretroactive as of January 1, 2004]

S.4. Operating Instructions and Use Limitations. – The manufacturer shall furnish operating instructions for the device and accessories that include complete information concerning the accuracy, sensitivity, and use of accessory equipment necessary in obtaining a moisture content. Operating instructions shall include the following information:

(d) the kind or classes of grain or seed for which the device is designed to measure moisture content and test weight per bushel;

N.1.1. Transfer Standards. - Official grain samples shall be used as the official transfer standards with moisture content and test weight per bushel. Moisture content values are assigned by the reference methods. The reference methods for moisture shall be the oven drying methods as specified by the USDA GIPSA. The test weight per bushel value assigned to a test weight transfer standard shall be the average of 10 test weight per bushel determinations using the quart kettle test weight per bushel apparatus as specified by the USDA GIPSA. Tolerances shall be applied to the average of at least three measurements on each official grain sample. Official grain samples shall be clean and naturally moist, but not tempered (i.e., water not added).

N.1.2. Minimum Test. - A minimum test of a grain moisture meter shall consist of tests:
(a) with using samples (need not exceed three) of each grain or seed type for which the device is used, and for each grain or seed type shall include the following:

(a) tests of moisture indications, (b)with using samples having at least two different moisture content values within the operating range of the device. , and if applicable,

(b) tests of test weight per bushel indications, with at least the lowest moisture samples used in (a) above.

T.3. For Test Weight Per Bushel Indications or Recorded Representations. – The maintenance and acceptance tolerances on test weight per bushel indications or recorded representations shall be 0.193 kg/hL or 0.15 lb/bu. The test methods used shall be those specified by the USDA GIPSA. as shown in Table T.3. Tolerances are (+) positive or (-) negative with respect to the value assigned to the official grain sample.

Table T.3. Acceptance and Maintenance Tolerances Test Weight per Bushel

Type of Grain or Seed	Tolerance (pounds per bushel)
Corn, oats	0.8
All wheat classes	0.5
Soybeans, barley, rice, sunflower, sorghum	0.7

UR.1.1. Value of the Smallest Unit on Primary Indicating and Recording Elements. – The resolution of the moisture meter display shall be 0.1 percent moisture and 0.1 pounds per bushel test weight during commercial use.

UR.3.4. Printed Tickets

(b) The customer shall be given a printed ticket showing the date, grain type, grain moisture results, test weight per bushel and calibration version identification. The ticket shall be generated by the grain moisture meter system.

Discussion: This proposal was developed to provide tolerances and to establish requirements for specific grain types to address grain moisture meters with an optional automatic test weight per bushel (TW) measuring feature.

The following information is excerpted from the 2002 GMM Sector summary. Knowledge of test weight per bushel (TW) is important not only in determining the price a producer receives for grain delivered to a grain elevator; it is also important to the grain elevator when grain stocks in storage are audited for quantity. Grain industry members reported that the proposed tolerances for TW are acceptable to the industry. Stressing that the grain industry urgently needs the capability to simultaneously (and easily) make TW determinations, they urged the GMM Sector to move forward on this issue. Some members were hesitant about moving forward at that time, citing concern about the unresolved issue of large negative bias in the Phase II data for one state. A review of the issue strongly indicates a procedural error at the field level was the cause for questionable data. It was pointed out that even if the GMM Sector recommends moving ahead at this time, the earliest date that changes in the code would become effective was January 1, 2004.

The GMM Sector considered whether the recommended changes should be retroactive or nonretroactive. Sector discussions centered on the requirement that meters measuring TW must provide some means to ensure that measurements of TW are not allowed to be displayed or printed when insufficient sample volume has been supplied. The GMM Sector recognized there is a general assumption that the means will include some sort of a level sensor installed in either the sample hopper or the test cell although the proposed code does not specify how this will be accomplished.

GMM Sector members in favor of making the proposed code retroactive noted that although moisture measurements are not significantly affected when samples are not of sufficient size to completely fill the measuring cell of a GMM, the TW measurement is greatly affected when the cell is not filled. Measurement of TW requires determination of two parameters; volume and mass. The vast majority of GMMs with TW capability presently in the field do not have means to assure that the measuring cell is completely full. If the cell is not filled completely, TW indications will be lower than they should be to the disadvantage of the producer selling grain. Some members in favor of making the code nonretroactive felt that GMMs with a window, through which the test cell could be seen, provide adequate means to verify that the cell is full. A grain industry member expressed the belief that compared to how test weight measurements are being made now, the worry about a sensor was trivial. It was argued that as long as the GMM could produce an accurate TW measurement when properly used, it was not important whether or not the hopper had a sensor. Some thought this was a facilitation of fraud issue and favored making the sensor requirement retroactive. Other members thought that making the code retroactive would unfairly penalize users of existing NTEP meters with TW capability.

One manufacturer indicated support for making the sensor requirement retroactive and pointed out that all existing GMMs they manufacture are covered by an NTEP CC and are hard coded to add the words “approx” or “approximate” to the display and print out TW measurements. That GMM Sector member also questioned how devices displaying “approximate” TW would be regulated if the sensor requirement was nonretroactive. Weights and measures officials were at first divided on this question. Some were of the opinion that they would permit the continued use of the device and display of “approximate” TW, if the device met the tolerance requirements, since “approximate” was added at the request of jurisdictions permitting a display of TW when tolerances did not exist as regulation. Others were concerned about what would happen in a court case when printed tickets which recorded “approximate” were used as evidence. States that presently do not permit “approximate” TW to be displayed or recorded indicated they would not change their policy.

The Committee discussed concerns about how to ensure meters have sufficient sample volume. The Committee was informed that older meters are equipped with a hopper where the operator can observe the sample volume; however most new meters do not have a weight sensor. The GMM Sector agreed that the proposed changes to paragraph S.2.6. to require a means for sensing when a sample is not sufficient should be a nonretroactive requirement. The Committee agreed that all issues were resolved and the item is ready for a vote at the 2003 NCWM Annual Meeting.

356(b) Grain Moisture Meters

356(b)-1 V T.3. For Test Weight Per Bushel Indications or Recorded Representations

Source: Central Weights and Measures Association (CWMA)

Recommendation: Modify paragraph T.3. as follows:

> **T.3. For Separate Test Weight Per Bushel Devices ~~Indications or Recorded Representations.~~ – The maintenance and acceptance tolerances on separate test weight per bushel devices used to determine the test weight per bushel of grain samples for the purpose of making density corrections in moisture determinations ~~indications or recorded representations~~ shall be 0.193 kg/hL or 0.15 lb/bu. The test methods used shall be those specified by the USDA GIPSA using a dockage-free sample of dry hard red winter wheat.**

Discussion: Prior to its amendment in 1992, Section 5.56.(b) applied to separate test weight per bushel (TW) devices used to determine the test weight per bushel of grain samples for the purpose of making density corrections in moisture determinations. When grain moisture meters were introduced with the capability to automatically indicate and record test weight per bushel values for the grain sample under test for moisture, the paragraph was amended to cover these devices. The tolerance assigned was the tolerance used by USDA GIPSA for their quart kettle test weight per bushel apparatus when tested as specified in the USDA GIPSA procedures using samples of hard red winter wheat.

At its August 2002 meeting, after a review of test weight per bushel data collected in a field evaluation of the proposed tolerances and test methods, the Grain Moisture Meter (GMM) Sector agreed to recommend that only Section 5.56.(a) of the Grain Moisture Meter Code recognize indications and recorded representations in weight per bushel for a vote at the 2003 NCWM Annual Meeting. New devices with test weight per bushel capability will be required to be fully automatic and to have means to ensure that measurements of test weight per bushel are not allowed to be displayed or printed when insufficient sample volume is available, thus providing an accurate measurement.

The GMM Sector decided that it was not appropriate for the Sector to recommend modification of Section 5.56.(b) of the Code to add tolerances for grain moisture meters with test weight per bushel capability. Non-NTEP devices with test weight per bushel capability will not be required to determine if sufficient sample volume has been provided for an accurate measurement. Section 5.56.(b) applies to non-NTEP devices which are not within the purview of the GMM Sector. Weights and Measures officials who are GMM Sector members suggested that paragraph T.3. should be revised to clarify that it applies to separate accessory devices (such as a beam balance test weight apparatus) used to determine test weight per bushel of grain samples for the purpose of making density corrections in moisture determinations. The Committee modified the title to clarify the tolerance applies to separate equipment other than grain moisture meters that are used to determine the TW used to make density correction in moisture determinations.

The Committee heard no unfavorable comments on this item. Therefore, the Committee is recommending the item for a vote at the 2003 NCWM Annual Meeting.

357 Near-Infrared Grain Analyzers

357-1 V S.1.1. Digital Indications and Recording Elements

Source: National Type Evaluation Technical Committee (NTETC) Near Infrared Grain Analyzer (NIR) Sector

Recommendation: Modify paragraphs S.1.1.(c) and (e) as follows:

> ***S.1.1. Digital Indications and Recording Elements.***
>
> ***(c) Analyzers shall be equipped with a communication interface that permits interfacing with a recording element and transmitting the date, grain type or class, constituent values, the moisture basis for each constituent value (except moisture), and calibration version***

identification. If the analyzer converts constituent results to a manually entered moisture basis, the "native" concentration and the "native" moisture basis must appear on the printed ticket in addition to the converted results and the manually entered moisture basis.

(e) Constituent content shall be recorded and displayed as percent of total mass at the specified moisture basis. The moisture basis shall also be recorded and displayed for each constituent content result (except moisture). If a whole grain analyzer that is calibrated to display results on an "as is" moisture basis does NOT display or record a moisture value, it must clearly indicate that results are expressed on an "as is" moisture basis. Ground grain analyzers must ALWAYS display and record a moisture measurement for "as is" content results (except moisture).

Add new paragraph S.1.1.(h) as follows:

(h) If the analyzer incorporates a built-in printer or if a printer is available as an accessory to the analyzer, the information appearing on the printout shall be arranged in a consistent and unambiguous manner.

Discussion: During its August 2002 review of NCWM Publication 14 checklist to add additional grains and criteria for moisture basis, the NIR Sector considered including text, "at the specified moisture basis," to the NTEP criteria that is based on NIST Handbook 44 paragraph S.1.1.(e). Total mass is the sum of constituent mass and moisture mass. Moisture mass, in turn, depends on the specified moisture basis. Unless both percent constituent content and its associated moisture basis are known, the actual constituent concentration cannot be known with certainty. To correctly reflect that the constituent percent of total mass depends upon the specified moisture basis and to bring the code into agreement with the Publication 14 NIR Checklist, the NIR Sector agreed that paragraph S.1.1.(e) should be modified as shown in the recommendation above.

It was also noted during the review of the proposed changes to the NIR checklist that the checklist referenced paragraph UR.2.3 Printed Tickets. NIR printed ticket must record specific information such as constituent values and each constituent's associated moisture basis. The NIR Sector noted that Publication 14 criteria should be based on specifications rather than user requirements. A review of the NIR code revealed that in cases where an analyzer converts constituent results to a manually entered moisture basis, there is nothing in the specifications that requires the device to record the "native" constituent concentration and the native moisture basis along with the converted results and the manually entered moisture basis. There is also no specification that requires the printed information be arranged in a consistent and unambiguous manner.

Consequently, the NIR Sector proposes to amend paragraph S.1.1. (c) to include specifications for recording the "native" constituent value and moisture value along with the converted results and the manually entered moisture basis, to amend paragraph S.1.1.(e) to recognize the need for moisture basis in determining the constituent mass and to add new paragraph S.1.1. (h) to include a specification that requires the printed information be arranged in a consistent and unambiguous manner.

The Committee heard no unfavorable comments on this item. Therefore, the Committee is recommending the item for a vote at the 2003 NCWM Annual Meeting.

357-2 V S.1.2. Selecting Grain Class and Constituent

Source: Carryover Item 357-1B (This item originated from the National Type Evaluation Technical Committee (NTETC) Near Infrared Grain Analyzer (NIR) Sector and first appeared on the Committee's 2002 agenda.)

Recommendation: Modify paragraph S.1.2. as follows:

S.1.2. Selecting Grain Class and Constituent. – Provision shall be made for selecting, and recording the type or class of grain and the constituent(s) to be measured. The means to select

the grain type or class and constituent(s) shall be readily visible and the type or class of grain and constituent(s) selected shall be clearly and definitely identified in letters (such as HRWW, HRSW, etc. or PROT, etc.). A symbol to identify the display of the type or class of grain and constituents(s) selected is permitted provided that it is clearly defined adjacent to the display. Minimum acceptable abbreviations are listed in Table S.1.2. Meters shall have the capability (i.e., display capacity) of indicating the grain type using a minimum of four characters in order to accommodate the abbreviations listed in Table S.1.2. If more than one calibration is included for a given grain type, the calibrations must be clearly distinguished from one another.
[Nonretroactive as of January 1, 200X]

Discussion: In 2002, the Committee indicated it was not appropriate to exempt specialty crops, an undefined commodity, from the entire NIR Code. The Committee agreed that it was more appropriate to address industry concerns about the proprietary nature of specialty crop calibrations by modifying paragraph S.1.2. The Committee proposed including language in paragraph S.1.2. that requires multiple calibrations (i.e., specialty crop calibrations) for a particular grain type to be clearly distinguished from one another.

In an attempt to arrive at a definition of "specialty crop," the NIR Sector considered one member's recommendation that a specialty crop might be one in which the constituents recognized by the CC for that crop type (e.g., soybeans: protein, and oil) could not be measured accurately using the normal calibration because the specialty crop had a spectral response that differed significantly from the spectral response of normal varieties of that crop. High oleaic soybeans (soybean varieties developed specifically to yield high concentrations of oleaic acid) were cited as a good example of a specialty crop requiring special oil and protein calibrations. In contrast, "high oil" corn was not considered a good example of a specialty crop, although seed companies may market it as such. It was pointed out that although "normal" corn typically has an oil content in the 3 percent to 4 percent range, the GIPSA corn oil calibration contains low (3 percent to 4 percent), mid-range (5 percent to 6 percent), and high (>7 percent) oil samples from three major seed companies. Sector members were in general agreement that it would be misleading to imply that this, or similar, "standard" calibrations are somehow unsuitable for use with high-oil corn samples. There was similar agreement that, from a regulatory point of view, it would not be desirable to allow the use of multiple calibrations (on the same device) for essentially the same commodity.

The NIR Sector searched for wording that would restrict the unnecessary use of multiple calibrations for the same basic grain type, but would still permit the use of proprietary calibrations where there was a legitimate need. The NIR Sector considered amending paragraph S.1.2. to include several variations of the statement "If a non-NTEP calibration is included for a given grain type, it must be clearly distinguished from other calibrations. The calibration description must clearly identify the unique end use property addressed by the calibration."

Ultimately, the NIR Sector decided the wording in the recommendation above, which was originally proposed by the S&T Committee, adequately addresses requirements for specialty crops.

The Committee heard no unfavorable comments on this item. Therefore, the Committee is recommending the item for a vote at the 2003 NCWM Annual Meeting.

358 Multiple Dimension Measuring Devices

358-1 I Tentative Status of the Multiple Dimension Measuring Devices Code

Source: Carryover Item 358-1. (This item originated from the Southern Weights and Measures Association (SWMA) and first appeared on the Committee's 2002 agenda.)

Recommendation: Change the status of the Multiple Dimension Measuring Devices Code (MDMD) from tentative to permanent.

Discussion: In response to comments from weights and measures officials and industry representatives the Multiple Dimension Measuring Devices Code was considered in 2002 for permanent status. The Committee heard that the code should be harmonized with the more stringent Canadian requirements. Industry representatives cautioned that other

issues may exist because the code was developed prior to some of the latest electronic technology. Therefore, in July 2002 the proposal was changed from a voting item to an information item pending further review.

The Northeastern and Western Weights and Measures Associations recommended the proposal remain an information item until a work group can review the code requirements.

During the 2003 NCWM Interim Meeting, the Committee heard that there remains a number of proposals to modify Canadian requirements for MDMD devices. The Committee was not aware of any plans for a U.S. work group. Consequently, in the interest of aligning U.S. and Canadian requirements, the Committee made the proposal an information item to allow time for review and comparison of U.S. and pending Canadian requirements.

For more background information, refer to the 2002 S&T Final Report.

360 Other Items

360-1 I Revise NIST Handbook 44

Source: Carryover Item 360-1 (This item originated from the Southern Weights and Measures Association (SWMA) and first appeared on the Committee's 1999 agenda as Item 360-1.)

Discussion: The Committee is not aware of any updates on the work to revise NIST Handbook 44. The Committee recommends that all parties interested in the status of this project contact the NCWM Board of Directors (BOD).

At its 2002 Interim Meeting, members of the Northeastern and Western Weights and Measures Associations agreed to continue to support the BOD's effort and encourage the BOD to fund this project.

The Committee also encourages the NCWM Board of Directors (BOD) to continue to provide financial support for the project. The Committee believes that the project to revise Handbook 44 is worthwhile and needed by Handbook 44 users.

360-2 I International Organization of Legal Metrology (OIML) Report

The OIML Report is included as part of the NCWM OIML Board of Director's 2003 Interim Agenda Item 4.

Many issues before the OIML, the Asian-Pacific Legal Metrology Forum (APLMF), and other international activities are within the purview of the S&T Committee. Additional information on OIML activities is available on the OIML web site at http://www.oiml.org/.

For more information on weighing devices, contact Steven Cook (NIST Weights and Measures Division Legal Metrology Devices Group (WMD-LMD)) by telephone at 301-975-4003 or by e-mail at steven.cook@nist.gov. For more information on taximeters, contact Juana Williams (WMD-LMD) by telephone at 301-975-3989 or by e-mail at juana.williams@nist.gov. For information on measuring devices, contact Wayne Stiefel (WMD-International Legal Metrology Group (ILM)) by telephone at 301-975-4011, or by e-mail at s.stiefel@nist.gov. For more information on electronic measuring devices, contact Dr. Ambler Thompson (WMD-ILM) by telephone at 301-975-2333 or by e-mail at ambler@nist.gov. For more information on grain moisture meters, contact Diane Lee (WMD-LMD) by telephone at 301-975-4405 or by e-mail at diane.lee@nist.gov. For more information on the R 117, Measuring Systems for Liquids Other Than Water and R 105, Direct Mass Flow Measuring Systems for Quantities of Liquids, and gas meters, contact Ralph Richter (WMD-ILM) by telephone at 301-975-4025 or by e-mail at ralph.richter.@nist.gov. Mr. Cook, Ms. Williams, and Ms. Lee can also be reached by postal mail at NIST, 100 Bureau Drive-STOP 2600, Gaithersburg, MD 20899-2600 or by fax at 301-926-0647. Mr. Stiefel, Mr. Richter, and Dr. Thompson can also be reached by postal mail at NIST, 100 Bureau Drive-STOP 2600, Gaithersburg, MD 20899-2600 or by fax at 301-975-5414.

The NIST WMD contracted with John Elengo (Consultant) to create a line item comparison document and analysis of requirements in NIST Handbook 44 Scale Code and OIML Recommendations R 76, "Non-Automatic Weighing Instruments," and R 60 "Metrological Regulations for Load Cells." To obtain a copy of the document, access the WMD

web site at www.nist.gov/owm. The work represents the first stages to harmonize U.S. and international requirements for non-automatic weighing systems and load cells. The Committee encourages comments on the draft document that compare R 76 and R 60 with corresponding requirements in NIST Handbook 44 Scales Code.

360-3 D Developing Issues

The NCWM established a mechanism to disseminate information about emerging issues which have merit and are of national interest. Developing issues have not received sufficient review by all parties affected by the proposals or may be insufficiently developed to warrant review by the NCWM S&T Committee. The developing issues listed are currently under review by at least one regional association or technical committee.

The developing issues are listed in Appendix B according to the specific NIST Handbook 44 Code Section under which they fall:

Part 1 – Scales
Part 2 – Vehicle-Tank Meters
Part 3 – Other Items

The status changes to developing issues are as follows:

Old Reference Number	Title of Item	New Reference Number	Status Change
Appendix B Part 1, Item 1	N.1.3.4.1. Weight Carts	320-11	January 2003 upgrade of item to an Information Item
Appendix B Part 1, Item 2	T.N.3.X. Vehicle Scales Equipped Only With Weighbeam and Used to Weigh Aggregate	None	Committee recommends the submitter withdraw this item from the developing agenda
Appendix B Part 2, Item 1	N.4.2. Special Tests (Except Milk-Measuring Systems), N.4.5. Product Depletion Test, and T.5. Product Depletion Test	331-6	January 2003 upgrade of item to an Information Item
Appendix B Part 3, Item 1	Update NCWM Publication 3, National Conference on Weights and Measures Policy, Interpretations, and Guidelines; Taximeters vs. Odometers Used for Transporting Fare Paying Passengers	360-4	January 2003 upgrade of item to a Voting Item

The S&T Committee encourages interested parties to examine the proposals included in the appendices and send their comments to the contact listed in each item.

The Committee asks that the regional weights and measures associations and NTETC Sectors continue their work to fully develop each proposal. Should an association or Sector decide to discontinue work on a developmental item, the Committee asks that it be notified.

360-4 V Update NCWM Publication 3, National Conference on Weights and Measures Policy, Interpretations, and Guidelines; Taximeters vs. Odometers Used for Transporting Fare Paying Passengers

Source: Southern Weights and Measures Association (SWMA) (This item first appeared on the Committee's 2001 Agenda as Developing Item 360-4, Appendix E. The item appeared in the 2003 NCWM Interim Agenda as Developing Item 360-3, Appendix D. During the 2003 Interim Meeting, the item status was changed to a voting item because there is a national consensus in favor of the proposed policy.)

Recommendation: Add the following interpretation to NCWM Publication 3, Section 3 – Specifications, Tolerances, and Device Inspection, Subsection 5 – Linear Measuring and Other Devices:

3.5.X Taximeters vs. Odometers Used for Transporting Fare Paying Passengers

Interpretation

Taximeters are required for use in transporting passengers and charging on a "distance traveled" basis. Vehicle odometers are not suitable equipment for such use. Odometers are suitable for use in charging "distance traveled" rates in rental vehicles in which customers pay on a "per-mile" basis for the right to operate the vehicle.

NIST Handbook 44 requires that devices must be suitable for their application with regard to their operating abilities, including their capacity, smallest division size, readability, performance, and design.

Handbook 44 General Code, which applies to all devices, requires in paragraph *G-UR. 3.3. Position of Equipment* that a device or system "*used in direct sales shall be so positioned that its indications may be accurately read and the weighing or measuring operation may be observed from some reasonable "customer and operator position."* Reasonable customer positions in taxicabs or other vehicles in which a driver transports passengers includes all passenger seats in a vehicle, both front and back. A properly installed taximeter's indications are easily readable from any position in the vehicle, both in darkness and light. An odometer cannot be read accurately from most positions in a vehicle other than the drivers' seat.

Handbook 44 General Code also requires specific markings on devices including manufacturer's name or trademark, model designation, and a nonrepetitive serial number. All markings must be located so that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device. The code also requires electronic devices to have provisions for applying security seals that must be broken before any changes that affect the accuracy of the device can be made. While taximeters meet these requirements, most odometers do not.

Further supporting the requirement for taximeters over odometers are the tolerances for the two devices prescribed in Handbook 44. Transporting passengers for hire normally involves shorter distances at higher cost-per-distance charges than for rental vehicles. The tolerances for taximeters in the Taximeters Code are *1 % for overregistration* (error in favor of the cab) and *4 % for underregistration plus 100 feet* (in favor of the customer). The tolerances for odometers in the Odometers Code are *4 % for overregistration and underregistration*, allowing 4 times as much error in favor of the operator. As taxi fares are usually much higher than rental car costs on a per mile basis, this allows for unreasonable and unacceptable errors that could be financially injurious to the customer.

It should be noted that no taximeter is required in cases where the charges are based on zones or flat rates, providing that such methods are in compliance with local ordinances and are conspicuously posted and understandable to customers. When taximeters are used, the rates for distances traveled and any extras must be posted as well.

Background: The SWMA asked the NCWM to consider a proposal to modify NCWM Publication 3 "Policy, Interpretations, and Guidelines" to include an interpretation in Section 3, Subsection 5 specifying that odometers are not suitable equipment for use in transporting passengers and charging on a "distance traveled" basis.

The Committee concurred with the SWMA that the charging of passengers based on an odometer reading is inappropriate and does not comply with paragraph G-UR.1.1. Suitability of Equipment. The Committee recommends using paragraph G-UR.1.1. as a basis to prohibit odometers from being used to charge passengers for distance fares.

The policy in the recommendation above was developed by SWMA and assist weights and measures officials in requiring taximeters to be used in charging passengers on a distance traveled basis when hiring a vehicle and clarifies that the driver is to transport the passengers at a predetermined rate or rates.

The Committee recognizes that individuals or small taxi companies that operate in less populated or rural communities might obtain all necessary operating permits and licenses from the local government yet begin operations using vehicle odometers as the basis for charging passengers, rather than taximeters. Local law enforcement agencies that are involved in the permitting process but not the inspection of the measuring devices (e.g.- local police or sheriff's departments) see no problem in using odometers if they are accurate, and demand something written specifically addressing the issue before they will offer assistance in obtaining compliance. The Odometer Code and Taximeter Code does not directly address this suitability issue therefore, it must be explained through interpretations such as the one in this proposal. An NCWM endorsed interpretation would be of valuable assistance in obtaining compliance.

The Committee recognizes that NCWM Publication 3 has not been published or updated since 1991, although there have been many changes to Handbook 44 that justify additional interpretations and policies. Currently, weights and measures officials must rely on and reference the NCWM Standing Committee Final Reports for help in interpreting many provisions found in the codes. NIST Handbook 130 now contains the interpretations, policies, and guidelines related to Laws and Regulations issues, which are presumably kept up to date with each new edition unlike Handbook 44. The Committee acknowledges there is no plan for any working group, technical committee, or organization to publish the policy in a procedural document. However, the weights and measures community needs to reference policy that clearly specifies that odometers are not suitable for determining distance fares when transporting passengers. The Committee intends for this information to appear in an historical document such as the Committee's final report.

The Committee has heard only comments in favor of this policy. Consequently, the Committee and the submitter of this proposal believes that the proposed policy is a good start to address the suitability issues that arise when odometers are used to charge passengers for distance fares. The Committee also encourages the SWMA and other weights and measures communities facing similar suitability issues to develop language for the Odometer and Taximeter Codes to further remedy this situation. The Committee recommends a change in the item status from developing to a vote at the 2003 NCWM Annual Meeting.

Richard W. Wotthlie, Maryland, Chairman

Clark Cooney, Oregon
Jack Kane, Montana
Michael J. Sikula, New York
Craig Van Buren, Michigan

Ted Kingsbury, Canada, Technical Advisor
Richard Suiter, NIST, Technical Advisor
Juana Williams, NIST, Technical Advisor

Committee on Specifications and Tolerances

Appendix A (Item 320-2)
Prescription Scales – Counting Feature Test and Other Procedures

(The following information was excerpted from the Final Report of S&T Committee for the Western Weights and Measures Association.)

How to Perform Piece Counting with Reference Weight Calculated by Prescription Scale

1. Tare the scale
2. Place reference (appropriate sample) number of pieces on scale pan.
3. Input reference quantity data into Prescription scale
4. Prescription scale waits for the weight to become stable
5. Prescription scale calculates reference weight (reference weight = current weight on scale divided by selected reference quantity
6. Scale stores the calculated reference weight and reference quantity
7. Scale switches to a count display with the current quantity displayed
8. Scale is now ready to continue counting – present number of pieces = current weight divided by reference weight

Reference Weight Optimizing Program

(Optional algorithm for counting feature described above)

When you place a number of pieces on the pan, which is at least three pieces higher than the reference count of pieces, the new reference weight is being recalculated and stored together with this higher reference count. The prescription scale could confirm this by some type of symbol located on the display.

	Weight [g]	Calculation [pieces]	Display [pieces]	Reference-weight [g/pieces]	Reference-count [pieces]	New
Start	5.123	5	5	1.024 6	5	Yes
1. count	25.500	24.888	25	1.020 0	25	Yes
2. count	26.450	25.931	26	1.020 0	25	No
3. count	50.700	49.706	50	1.014 0	50	Yes
4. count	30.050	29.635	30	1.014 0	50	No

Recommended Prescription Scale Characteristics

- The scales should be Class I or II
- Counting mode must be evident on display
- Scale display must be able to differentiate between counting and weighing
- Scale capacity would range from 310 g to 620 g
- Suggested scale divisions of d=0.001 g, e=0.01 g
- Scale equipped with a zero count indicator
- Scales equipped with zero-count setting application
- Verification resolution 0.010 g
- Linearity +/- 0.001 5 g
- Reproducibility +/- 0.001 g

Summary

The following proposal is a suggested guideline for testing potential prescription counting scales to ensure counting accuracy. These procedures describe the tests to be used in determining various parameters of a prescription counting scale.

The prescription counting scale test procedures determine:

a) The precision of determining mean piece weight,
b) The minimum and maximum mean piece weights,
c) The minimum weight and minimum piece count that may be used to determine mean piece weight,
d) The linearity in determining accurate mean piece weight throughout the prescription scale weight range,
e) The linearity and accuracy of determining mean piece weight given a range of pill quantities,
f) The percent of a pill required for indicating the next pill quantity.

Recommended Method for Determining Prescription Scale Accuracy During Counting Function

The following test plan should be carried out to approximate most of these values. The resolution and accuracy internal to the device cannot be determined; however, these tests may identify significance or a means to approximate the internal resolution.

Assumptions

a. Tests must be performed in a laboratory setting to minimize external influences. An assumption must be made that the scales are Class I or II balances and testing must be performed under suitable Class I scale conditions that is, free from temperature fluctuations, vibration, draft, calibration, warm-up, level, and free from static or other electro-magnetic sources. Use ASTM E 617 Class 2 (OIML R 111 Class F1) or better calibrated weights, proper weight handling conditions, and ensure weight cleanliness.
b. Tests will be performed on at least two of each scale device. Testing on a third device will be required should significant variations be noted on any one scale of the same class.
c. Class 2 or better (Class 1 preferred during calibration) test weights will be used during testing. Clean and air dry all test weights using an approved method. If unable to determine Class the appropriate 1/2 weight cleaning procedure, assume that the use of denatured alcohol is an approved solvent for cleaning that will result in no residue on weights.
d. Perform all tests using the same test weight set.
e. Preference is for the same operator and same environmental setting be used to perform all like tests. Preference is for all like devices to be tested at the same time or as close as possible.
f. Each test defined below should be performed without interruption in time or concentration. After the test is performed, the same test should be repeated on the second device immediately thereafter. If necessary, a third device should be tested. This is to ensure repeatability under the same or similar conditions.
g. All tests will be performed a minimum of 5 times or as stated in NTEP testing procedures if an equivalent test exists.

i. All test results must be recorded when performed. All exceptions, retries or retesting, significant pauses in testing and aborted tests or scale recalibrations must be noted before, during and after test. Time should be recorded at the beginning and completion of each major test.

j. Once testing begins, **absolutely no recalibration** of the scale may occur throughout the **entire** test sequence. (Should recalibration be needed during the testing; the entire testing must be aborted and properly documented and testing restarted at the beginning.)
    i. Calibrate scale using approximately two-thirds total load of scale
    ii. Verify scale calibration conforms to Class I or II (NIST Handbook 44 Table 6)
        1. Verify by approaching calibration weight from below and above as defined in NTEP testing procedures.
    iii. Verify linearity across entire range (per NTEP)
    iv. Verify corner load (per NTEP)
    v. Verify calibration every hour while testing. If greater than +/-0.001 g error; calibration error must be sufficiently explained before resumption of testing. All tests to last known good calibration must be repeated; with original test results also noted.
    vi. Record all results.

k. Record all results within a spreadsheet. Use formulas wherever possible. Record all significant digits. Display in fixed format. Display all calculated values to 6 significant digits. Note any formula or calculation that uses a rounded or truncated value. Test results sheets should also contain other good laboratory practices background data. (e.g., Time, date, who, SN,)

l. Before starting the tests defined below, perform the following NTEP tests. These tests must be performed daily before testing starts. Use a single test weight nearest the two-thirds total load. (or larger if required)
    i. Verify calibration using approximately two-thirds total load of scale.
    ii. Verify return to zero after each test above. Tare as needed. Do not continue testing if repeatability of zero is unreliable (e.g., must repeatedly tare for zero values greater than +/- 0.001 g.)
    iii. Verify linearity across entire range (per NTEP) accuracy and repeatability.
    iv. Verify corner load (per NTEP).

    For each test, Record the actual test weight, displayed value, note fluctuations in display as comments.

    Calculate error, percent error in spreadsheet
    v. Record all results.
    vi. Steps i) and ii) must be performed at the beginning and completion of each test phase to insure test reliability.

m. If a test range of values requested for N are not specified, where N is the ….. Assume 5, 10, 30, 100, 200 or some N to match test weight specified) these represent minimum scale reference quantities and typical in-use values for reference quantities. The maximum N may need to be determined based on the test being performed and the test weight specified.

n. If a test range of values request for test weights is not specified. Assume 0.020 g, 0.030 g, 0.300 g, 0.400 g, 1.000 g and 10.000 g. These values represent the smallest drug weights, average and median drug weights and upper end and maximum drug weights)

1. Scale communication interface minimum piece weight
   All tests for this section assume communication with the scale CPU from a computer or via the RS-232 interface. The recorded value should be to the highest resolution accepted by the scale. (Repeat once)
   a. What is the highest resolution value accepted by the scale? (00.123 45…9… g)
   b. What is the minimum acceptable piece weight accepted by the scale via the RS-232 interface? (in xx.xxxxx grams format)
   c. What is the maximum acceptable piece weight accepted by the scale via the RS-232 interface?
   d. What is the highest resolution value returned by the scale?
   e. What is the resolution recorded in the library? (00.123 4 g)

2. Scale calculated minimum piece weight
   All tests for this section assume the scale is performing the piece weight calculation. (e.g., An operator places N pieces on the scale and the scale calculates by total weight / N = piece weight.) Determine by using the same reference weight(s) and adjusting N. (Note: Reference weight must be greater than scale minimum weight. Preferably 2x to 5x minimum scale weight.) (Repeat once)
   a. What is the maximum resolution piece weight value returned by the scale?
   b. What is the minimum number of reference pieces accepted for determining reference weight?
   c. What is the minimum piece weight that will be calculated by the scale?
      i. Does this vary by the number of pieces? (i.e., Changes in N)
   d. What is the minimum total weight that the scale will calculate a piece weight?
      i. Does this vary by the number of pieces? (i.e., Changes in N)
   e. Record the following
      i. Actual weight used
      ii. Reference quantity set (N)
      iii. Scales calculated reference piece weight (ActPcWt)
      iv. Theoretical reference piece weight (TPcWt)
      v. Error (TPcWt – ActPcWt)
      vi. Percent error = (TPcWt – ActPcWt) / TPcWt * 100)

3. Scale accuracy in determining piece weight
   These tests are to determine the scales algorithm in piece weight calculation. Testing assumes use of test weights as a quantity. Where practical, use nearest whole test weight. Otherwise use as few weights as possible.
   a. What is the accuracy of the scale determining piece weight?
   b. Does the accuracy change by changes in N?
   c. Repeat for N = 5, 10, 30, 60, 100 and 200 using a 5.000g test weight.
   d. Does the accuracy change by changes in total weight?
   e. Repeat for approximate piece weight (after scale calculation) to be near 0.020 g, 0.030 g, 0.300 g, 0.400 g, 1.000 g, and 10.0 g with a count in the 60 to 180 range. (i.e., 2.000 g, 5.000 g, 20.000 g, 50.000 g, 100.000 g, and 200.000 g test weights)
   f. Use single reference weight nearest 25 percent of total load capacity.
      1) Adjust N as required to achieve average pill pc.weight (0.300 g – 0.400 g). (Example 310.000 g * 0.25; locate nearest single reference weight. Nearest Single Reference Weight / 0.300 = N)
      2) Repeat for 50 percent and 90 percent of total load capacity by estimating N and then immediately finding N

3) Record the following
   i) Actual weight used
   ii) Reference quantity set (N)
   iii) Scales calculated reference piece weight (ActPcWt)
   iv) Theoretical reference piece weight (T.PcWt)
   v) Error (TPcWt – ActPcWt)
   vi) Percent error = (TPcWt – ActPcWt) / TPcWt * 100)

4. Next pill tests

   These tests are to determine the counting algorithm used within the devices

   a. What percent of a piece weight is required to generate the next count? (i.e. N+1)
   b. Does this vary by piece weight value?
   c. Does this vary by count?
   d. Does this vary by scale settings?
   e. Perform tests at approximately 25, 50, 75 and 90 percent total load
      i. Choose nearest whole weight (W1)
   f. Perform test with N = 30 and 100
   g. Scale to calculate reference piece weight
   h. Place test weight on scale
   i. Extract and Record scales reference piece weight. (PcWt)
   j. Record calculated piece weight. (W1 / N)
   k. Add test weight(s) in 0.001 g increments (or using binary search procedure) until N+1 value is reached.
   l. Record total weight (and individual test weights) to nearest 0.001 g (W2)

      (proper protocol must be followed in approaching the N+1 count. Follow NTEP test procedures for slowly adding test weights in a reliable, predictable fashion. If the >0.001 g added and N+1 event occurs, sufficient test weights must be removed to reliable predict weight required for N+1 threshold. Do not drop weight onto scale pan. Do not touch scale pan when placing weight on scale. Do not touch scale pan when removing weight. Do not press on scale pan when removing weight.)

   m. Add test weight(s) in 0.001 g increments (or using binary search procedure) until N+2 value is reached. (W3)
   n. Record total weight (and specify individual test weights used) to nearest 0.001 g
   o. Calculate and Record percent of piece weight required
      ii. (W2 – W1) / PcWt * 100 %
      iii. ((W3 – ((W3-W2)/2)) / PcWt * 100 %
      Note: both values calculated in i) and ii) above should be identical
      iv. (W3-W2) = PcWt ???
   p. Once weights required for N+2 and N+1 are known; start with weight for N+2 + (PcWt / 2)
      i. Remove weights in 0.001 g increments (or using binary search) until N+1threshold reached.
      ii. Record total weight (W4)
      iii. Remove weights in 0.001 g increment until N reached
      iv. Record total weight (W5)
   q. Calculate and record percent of pieces required
      i. W4 – W3 = difference for N+2 event
      ii. W5 – W2 = difference for N+1 event
      iii. W5 – W4 = PcWt ???

5. Counting accuracy based on known piece weight. These tests are to determine the linearity and accuracy of counting by using known weights and programmed piece weights.

   a. Perform tests with piece weight set to 0.020 g, 0.030 g, and 0.050 1 g
   b. Test at 20x, 50x, 100x, 150x, 200x counts.
   c. Record
      i. Actual total weight required

ii. Specific test weight(s) used,
iii. N
iv. Expected total weight,
v. Error in weight
vi. Percent error

d. For 0.0501 g piece weight, test using 100.000 g weight (W1)
   i. Set piece weight to 0.0501 g
   ii. Place the 100.000 g weight on scale
   iii. Record count (N)
   iv. Add weight(s) in 0.001g increments until N+1 count reached (W2)
   v. Record
      1. Actual total weight added,
      2. Specific test weight(s) used,
      3. Error in weight
      4. Percent error ((calculated weight needed for N+1 – actual weight) / calculated weight needed for N+1)
   vi. Continue adding weight in 0.001g increments until N+2 count reached (W3)
   vii. Record
      5. Actual total weight added,
      6. specific test weight(s) used,
      7. Error in weight
      8. Percent error ((calculated weight needed for N+1 – actual weight) / calculated weight needed for N+1)
   viii. Calculate the following
      9. W4 = W2+(W3-W2)/2 (represents N+1)

e. Repeat test above using 200.000 g weight

Verifying Accuracy of a Counting Scale

A counting scale calibration assumes the following parameters are available when operating in the piece counting mode.

D(i) Internal scale resolution used during counting. D(i) will be higher resolution than e and d parameters currently on the weighing scale.

PcWt(min) Minimum mean article weight. PcWt(min) should follow normal distribution curves.

Class (count) Counting accuracy class. Class (count) determines the percent accuracy of the counting feature. Ideally, Class (count) should mimic the weighing Class I, II, III.

In addition, these parameters may be needed internal to a counting scale:

PCs (min) Minimum number of pieces allowed to establish PcWt. The PCs (min) is determined by the article type being counted. To some degree, the PCs (min) are established by the Normal Distribution of the article being counted.

CNT (min) PcWt (min) / D(i) = minimum number of scale intervals (D(i)) between each article counted.

Because article counting depends directly on the weight capacity, resolution, and mathematical routines internal to an electronic digital scale, no absolute counting calibration should be necessary or possible. The counting scale will support a method of establishing an article reference weight by either calculation based on an expected quantity or by direct entry (either manually or via a computer interface). However, a means must be provided to verify counting calibration based on an article reference weight.

Counting Scale --- Verification of Counting

Two alternative methods will be available to the scale manufacturer to demonstrate counting accuracy.

Method #1 - Using a first test weight and a selected quantity to establish the article reference weight. And a second test weight to verify the count accuracy within the Class (count) tolerance.

Method #2 - Counting scale retrieves a known (and published) article reference weight and a test weight to verify the count accuracy within the Class (count) tolerance.

Both methods assume the scale weighing calibration has been performed and the article reference weight (determined or pre-programmed) is typical for the intended application. The article reference weight must also be selected to result in the use of test weights typical for the Class of scale being used. The test weight value should be an even multiple of the article reference weight to simplify verification by using a singular test weight.

Method #1 – Using a Reference Quantity to Verify Counting Accuracy

This method assumes a known (published) reference quantity and a test weight will be used to establish the article reference weight and then this established article reference weight is used to verify the count accuracy to within the specified Class (count) accuracy.

The advantage to this method is that any test weight set for the Class scale may be used to verify proper operation of the counting scale. The operator selects two test weights that are X and 10X to 100X values within the published scale weighing range and greater than the PcWt(min).

The counting scale may support multiple quantities for the operator to select from in establishing the individual reference weight value. These quantities allow the scale to calculate an article reference weight based on a theoretical sample size of N articles.

Determining theTest Weights Needed

1. Determine the article quantity to be used for establishing the reference weight. (N)
2. Calculate a test weight #1 (TW1) that is above the PcWt(min) and typical for the articles counted. (Example: PcWt(min) * N < test weight #1 (TW1))
3. Calculate a test weight #2 (TW2) that is 10X to 100X the test weight #1.

Establishing the Article Weight:

4. Place the scale in the counting mode.
5. Place the scale in the mode used to establish article reference weights for the quantity of articles (N).
6. Following the scale manufacturer's direction, place the TW1 on the scale to establish the article reference weight. (Ref.Weight = TW1 / N)
7. Wait for the scale to indicate that the article reference weight calculation is complete.
8. Verify the quantity displayed.

Verify the Counting Accuracy Using the Established Article Reference Weight:

9. Zero the count display.
10. Place test weight #2 (TW2) on the counting scale.
11. Verify the quantity display is 10 to 100 articles (as previously calculated) are within the Class (count) tolerance.

A scale manufacturer may choose to publish the calculated article reference weight, N, TW1, TW2 and tolerance range values and procedures to simplify the verification task. A table of calculated article reference weights, N, TW1, TW2 and tolerance range values may be published for scales with multiple weighing ranges (and therefore counting ranges and corresponding tolerances).

Calculated article reference weight	N	Test Weight #1 (TW1)	Test Weight #2 ± (TW2)	Expected Count and acceptable Tolerance
0.020	10	0.200 gram	20.000 gram	100 ± x
0.100	10	1.000 gram	100.000 gram	100 ± x
0.100	10	1.000 gram	300.000 gram	300 ± y
0.300	10	3.000 gram	300.000 gram	100 ± x

Method #2 – Using a Reference Article Weight to Verify Counting Accuracy

This method assumes a pre-programmed, known and published article reference weight will be used to verify the count accuracy to within the specified Class (count) accuracy. The pre-programmed article reference weight should be typical for the articles being counted. The operator may be able to select from a list of article reference weights or program a specific article reference weight.

Determining the Test Weight Needed

1. Calculate the test weight needed to be in the 10X to 100X range of the article reference weight. Pre-programmed article reference weight * 100 = test weight #1 (TW1).

Verify the Counting Accuracy Using the Established Article Reference Weight

2. Zero the count display.
3. Place test weight #1 (TW1) on the counting scale.
4. Verify the quantity display is 10 to 100 articles (as previously calculated) are within the Class (count) tolerance.

A scale manufacturer may choose to publish the article reference weight, TW1 and tolerance range values and procedures to simplify the verification task. A table of article reference weights, TW1 and tolerance range values may be published for scales with multiple weighing ranges (and therefore counting ranges and corresponding tolerances).

Article Reference weight	Test Weight #1 (TW1)	Expected Count and acceptable Tolerance
0.020	20.000 gram	100 ± x
0.100	100.000 gram	100 ± x
0.100	300.000 gram	300 ± y
0.300	300.000 gram	100 ± x

Appendix B (Item 360-3)
Developing Issues

Part 1, Developing Issues - Scales

Part 1, Item 1 **N.1.3.4.1. Weight Carts**

Discussion: The status of this proposal was changed to an information item and now appears as Item 320-11.

Part 1, Item 2 **T.N.3.X. Vehicle Scales Equipped Only With Weighbeam and Used to Weigh Aggregate**

Source: Central Weights and Measures Association (CWMA)

Recommendation: Add new paragraph T.N.3.X. to the Scales Code as follows:

> **T.N.3.X. Vehicle Scales Equipped Only With Weighbeam and Used to Weigh Aggregate. – The minimum tolerance applied to vehicle scales equipped only with a weighbeam and used solely to weigh aggregate products shall be 100 lb.**

Discussion: The Central Weights and Measures Association requested input on this proposal to increase the tolerances for vehicle scales equipped with only a weighbeam and used to weigh aggregate.

The Committee heard numerous comments that the proposal has no technical merit and the scale tolerances should not be modified to accommodate equipment that is not able to maintain NIST Handbook 44 tolerances and other technical requirements. Consequently the Committee recommends the CWMA withdraw this item from its agenda.

Part 2, Developing Issues – Vehicle-Tank Meters

Part 2, Item 1 **N.4.2. Special Tests (Except Milk-Measuring Systems), N.4.5. Product Depletion Test, and T.5. Product Depletion Test**

Discussion: The status of this proposal was changed to an information item and now appears as Item 331-6.

Part 3, Developing Issues – Other Items

Part 3, Item 1 **Update NCWM Publication 3, National Conference on Weights and Measures Policy, Interpretations, and Guidelines; Taximeters vs. Odometers Used for Transporting Fare Paying Passengers**

Discussion: The status of this proposal was changed to a voting item and now appears as Item 360-4.